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Search for a Better Chestnut Tree

In less than fifty years the destructive chestnut blight fungus reduced our native American chestnut from an important timber species to an understory shrub. For many years the U.S. Department of Agriculture carried on an extensive chestnut breeding program aimed at developing blight-resistant hybrids that would grow rapidly.

Between 1947 and 1955, fifteen hybrid chestnut plots were established in thirteen eastern and midwestern states to test these hybrids under forest conditions. When these plots were reexamined in 1973, ten percent of the surviving 250 hybrids were blight-free, and had the timber form and rapid growth of the American chestnut. Researchers are searching for a good vegetative-propagation technique to develop the chestnut so they can establish clonal plantings or seed orchards on a limited scale.

NE-1104

Forest Habitats Cause Important Differences in Species

Research in New England indicates that species composition of both climax and successional stands is limited by soil materials. In areas of granitic bedrock, sugar maple, and white ash are most abundant on cove sites, where rich deposits of organic material accumulate. Some of the best softwood stands of red spruce and white pine are found on glacial outwash. Red maple and birch are common in young or cutover areas of wet basal till where the stands will gradually revert to softwoods. Some fairly poor stands of softwood and hardwood occur on areas shallow to bedrock.

Scientists at Durham have identified 11 habitat conditions that cause important differences in composition, productivity, and logging opportunities of species. These habitats are found in areas of different mineralogy and climate that also cause differences in forest conditions. This information is used by National Forest personnel working on ecologic land typing and by Soil Conservation Service personnel.

NE-1151

The Shelterwood Approach for Residual Areas

Researchers have developed an even-age silvicultural prescription for removal and regeneration of residual areas between cleared strips--a shelterwood approach. Results after two growing seasons indicated that mortality, primarily wind-damage, is not excessive even in heavily shelterwooded residual strips where up to 75 percent of basal area was removed. It may be even less than in residual strips treated less drastically.

The proper selection of leave-trees in residual areas between cleared strips may provide shelterwood conditions suitable for spruce regeneration that will result in a management/harvest plan that develops future stands less susceptible to spruce budworm damage.

NE-1152

Regeneration on the Allegheny Plateau

Few of our cherry-maple stands on the Allegheny Plateau have enough advance seedlings. Recent studies show that shelterwood cutting is a practical way to establish enough seedlings to establish a stand. Tests in stands with one-third cut, followed by a final harvest in 5 to 10 years provide the best environmental conditions necessary to regenerate cherry-maple stands. The one-third cut provides additional light and moisture for seedling establishment and survival, and stimulates optimum seed production. It does not provide enough light for rapid seedling height growth. This lessens the impact from deer browsing since seedlings less than 8 inches tall receive only minor browsing pressure.

Maple stems are often concentrated in the lower crown classes, and many stands lack adequate seed sources of these species. A period of several thinnings may be required to develop good seed producing crowns on the maples present.

These studies will provide managers with guides to evaluate seed producing potential and suggest possible corrective measures for inadequate seed supply.

NE-1351

Growth of Upland Oak Can Be Increased 20 Percent

Researchers have found that thinning upland oak stands increases diameter growth regardless of age or site. The heavier the thinning, the greater the response; but within an acceptable range of stocking growth, rates can be increased up to 20 percent.

Studies show that the diameter growth rates of the largest 40 trees per acre and growth response after thinning, relative to a control, were better in younger stands. Growth rates were higher on better sites, but the growth response relative to control was not influenced much by site. In most instances the largest 40 trees per acre responded as well or better to thinning than the second largest 40 trees.

NE-1401

New Trees for Reforestation

The use of hybrid poplar clones developed in the Northeast has moved beyond the landscape market and is now part of the reforestation program in North America. A private company is planting 1,000 acres annually and will double that as their nursery capacity is increased to over

1,000,000 cuttings. The output for urban uses is expected to increase next year as the largest grower doubles production to 600,000 plants.

The proven usefulness of the proper clones for short rotation crops and adverse sites such as mine spoils indicate that production will expand greatly in the next few years. Care must be taken to tailor the clones to the regions and sites if the program is to avoid serious setbacks.

Researchers have found that hybrids of pitch and loblolly pine show fast growth at young ages on a variety of sites. Annual growth of some hybrid combinations has been close to six feet well north of the natural range of loblolly pine. New selections are being added to the breeding orchards and new combinations will be available for testing in new areas such as the Mid-Western states, disturbed sites in the Northeast, and more northerly regions. The program is already international in scope with exchange of plant material with Canada and Korea.

NE-1501

Simple Silviculture of Sugar Maple Reaps Double Benefits

Researchers have found that sweet sugar maple trees have more vascular ray tissue and that this tissue is the principal storage site for carbohydrates. Increasing the amount of carbohydrate storage tissue in stems of sugar maple trees may be one way to increase sap sweetness.

Increasing the radial growth rate by thinning, fertilization, or a combination of the two will at the same time increase the amount of ray tissue per unit of wood. Managers will be able to increase sap sweetness in many existing sugar maple trees. This in turn will be compatible with their management of sugar maple for wood.

NE-1601

Clearcutting Releases More Nutrients into New Hampshire Streams

Studies show that clearcutting hardwoods in New Hampshire affects stream water quality and biota by increasing nutrients leached to streams. Scientists compared six cutting configurations and found that progressive cutting of narrow strips caused the least increase in stream ion concentration and that clearcutting in whole blocks caused the greatest increase.

Stream water draining a forest that had never been cut seemed more regulated by precipitation, soil water movement, and chemical weathering than by forest succession. Application of up to 25 MT/ha of domestic sewage sludge to forest stands did not impair stream water quality. Studies indicate differences in transpiration among hardwood species are not likely to produce significant watershed streamflow differences.

Where Sediment Comes from in The Forests

Few people realize that small amounts of sediment are a natural product of all forested land. Non-point pollution, over and above naturally produced sediment, usually originates from sources such as stream channels disturbed by logging, skid trails and logging roads, and the cutover forest floor.

Poorly managed logging roads (too muddy, steep, or close to streams) are more apparent sediment sources, although most productivity coincides with the period of active logging. The leaf-covered forest floor is so absorbent and so well protected from raindrop impact that sediment rarely originates from this source. Tree cutting has little or no effect on this soil-protective role of the forest floor, a fact all too seldom recognized.

Researchers have found that the control of non-point pollution of silvicultural origin rests not on regulated forest cutting, but on due care for soil and water during logging. This means that proper stream management practices are essential. Educating the public to these ideas is perhaps the most urgent task now confronting our watershed scientists.

NE-1605

Reclamation of Surface-Mined Appalachia

It has been estimated that 90 percent of surface mining has been or is being conducted on forested areas where 65-85 percent of the land-form is steep. In response to the U.S. Department of Agriculture and the Forest Service commitment to protect and manage aesthetics and opportunities created by National Environmental Protection Agency and the recent enactment of Surface Mining Control and Reclamation Act, our researchers have started a new program combining aesthetics and landscape quality with various surface mining and reclamation systems.

Vegetation of steep slopes and toxic spoils often requires the application of soil amendments, planting of acid-tolerant species, and introduction of beneficial microorganisms. Research on the various species of microorganisms that are known to form beneficial associations with plant roots is showing the importance of these organisms in establishing good vegetation on mine spoils.

Serious adverse effects on the environment both on and off the mining site result when sediment and chemical pollutants enter streams. Four hundred water quality sampling stations have been established on first order streams from Pennsylvania to Alabama. About one-third of these are on unmined watersheds, a third on recent surface-mined watersheds, and a third on old surface-mined watersheds. A preliminary review of the data indicates that strip mining usually causes a deterioration in the quality of water which drains these watersheds, yet in a number of instances, the quality of stream water on old and recent mined watersheds was almost identical to that of nearby unmined watersheds.

Nationwide Outdoor Recreation Participation Surveys

Researchers have evaluated 22 nationwide recreation surveys conducted to identify trends in Americans' participation in a variety of outdoor recreation activities during the past 20 years. This joint study by the Station and the University of Vermont included surveys by both public and private agencies. The original cost of the nationwide studies evaluated in this report is estimated to be in excess of \$4 million; and the studies have probably influenced the expenditure of many additional millions in public planning and private investment. This identification of participation trends provided a unique and low cost extension of the original surveys.

NE-2201

Controlling the Gypsy Moth

Our forest economists have been working closely with State and Private Forestry's Forest Insect & Disease Management staff to keep track of the gypsy moth. Recent studies show that while some forest stands come through gypsy moth outbreaks with little or no tree loss, a few stands suffer heavy damage.

Models for predicting losses have been developed and are now being tested. These models make use of easy-to-measure key characteristics of stand conditions to estimate loss such as tree vigor, species, elevation, tree size distribution, and position on slope. Studies are underway to determine longer term influences of the gypsy moth on tree regeneration and wildlife habitat. This information will aid planners in making decisions about how and where to direct their program efforts.

NE-2214

Spruce Budworms Program

The Canada/United States Spruce Budworms Program (CANUSA), a joint international effort with the Canadian Forestry Service to develop effective spruce budworm management techniques, has just completed its first full year of activity.

In the first field season some promising results seem to be developing in monitoring of spruce budworm populations with pheromones, use of an automatic egg mass counter, damage and hazard rating techniques, the environmental impact and assessment of chemicals, improved application technology for chemicals and biologicals, and appraisals of pre-salvage strategy for budworm management. The Program supports an integrated pest management demonstration in Maine aimed at reducing budworm damage by developing specific management plans for specific tracts that use silvicultural treatments, harvesting and more precise spray application. This is a joint effort with the University of Maine, several private timber companies, and Baxter State Park.

New Information on Pruning, Decay, and Compartmentalization

Most pruning recommendations state a branch should be pruned flush. This can be very dangerous when a branch collar surrounds the branch. The expanded concept of tree decay is outlined in a new publication, Tree Decay, An Expanded Concept, Agriculture Information Bulletin 419.

There has been much confusion over the last 100 years regarding what is heartwood and what is discolored wood in living trees. Scientists have revised our thinking on heartwood because decay is compartmentalized in heartwood of living trees.

The boundaries of columns of discolored wood in living trees contain tissues rich in phenols. These chemicals serve to limit the spread of microorganisms. Research on the mechanisms of compartmentalization helps to explain how trees wall off injured and infected tissues.

The barrier zone is a protective tissue formed by the cambium after wounding. The tissue has never been described, yet it is one of the most important tissues in a tree. Recent investigations show that the barrier zone is a non-conducting tissue. This information will set a new baseline for understanding tree problems around the world.

NE-3102

Product Volume Study of Red Oak and Black Cherry Veneer Logs

Veneer-quality logs of black cherry and red oak were converted into face veneer for a recent study. Measurements were made in all phases of processing from the tree to the final dry veneer sheets. Sixty-six percent of the total log volume for red oak and 71 percent for black cherry were converted to usable veneer. Butt log taper accounted for most of the difference between the two species. These results will furnish basic data for examining the joint product volume relationships between sawlogs and veneer logs in the standing tree. These data also provide veneer log buyers and mill managers with information to judge their veneer recovery efficiency.

NE-3201

Use Low-Grade Instead of High-Grade Timber

Using computers, our researchers have determined through commonality (or standardization) the standard-sized blanks that should be used to manufacture thousands of furniture and cabinet parts. This can be done without a great deal of waste.

System 6 is a method used to convert unused timber to the standard-sized blanks. Low quality and small stems are bucked into 6 foot sawbolts that are made into two-sided cants. These cants are ripped into boards and dried. The dried boards then go through an automatic rough mill when they are rough planed, gang cross-cut, and gang ripped. This

process removes virtually all defects. These boards can then be glued edge to edge to produce the finished blank or they can be made into longer lengths by using SEM (Serpentine End Matching).

Low-grade timber for this project was removed during thinning from three National Forests, and was made into tables, chairs, kitchen cabinets, and upholstered love seats.

NE-4204

Meeting Future Needs for Hardwood Raw Materials

To learn more about potential yields from increased harvesting and use of small trees from intermediate cuttings, researchers determined alternative product yields from thinning Allegheny hardwood poletimber stands on the Monongahela National Forest.

Above ground biomass of the thinned trees totaled 69.2 tons per acre including 17.9 tons of round pulpwood, 16.5 tons of sawable logs and bolts, and 34.8 tons of chippable wood from tops and small trees. The sawable bolts and logs yielded an average of 3,695 board feet per acre of lumber and pallet cants.

The thinned area was typical of several million acres of forest land in the Northeast. If economical means of harvesting and processing thinning yields can be developed, timber management on both public and private forests can be significantly advanced.

NE-4206

New Mathematical Programing and Models

A new mathematical programing technique, an interactive, multiple-objective linear programing approach, was developed by our researchers. This procedure uses a combination of linear programing and vector-maximum techniques, and is undergoing rigorous testing on the Mark Twain National Forest.

Econometric market models permit researchers to reduce volumes of market data to a set of functional relationships that resemble the real world. The models help determine the cause and effect of changes within the market, and allow the forecasting of the impact of changes in market variables. Information gained from the models will provide decisionmakers with invaluable input in establishing long-run timber growth, production, and marketing goals, and in formulating forest policies and programs.

Identifying Effects of Grade of Pure Maple Syrup

Through the concentrated effort of maple syrup industry members, extension specialists, and Forest Service research, the long-term decline in maple syrup production has stopped.

A marketing experiment was used by researchers at three supermarket locations in the Boston area to test the potential effects of product grade, price, and point-of-purchase information on pure maple syrup sales.

The major findings of the study were that product grade had virtually no effect on sales; sales varied inversely with price, i.e., high prices meant decreased sales; and the presence of point-of-purchase information increased sales by a third. This information will be helpful in formulating marketing strategies for pure maple syrup sellers.

STATION BIBLIOGRAPHY

Applegate, James E., Silas Little, and Philip E. Marucci.

1979. Plant and animal products of the Pine Barrens.

In Pine barrens: Ecosystem and landscape, chapter 2. R. T. T. Forman, ed. Academic Press, New York, p. 25-36.

Describes plant and animal products of the Pine Barrens environment and analyzes changes in their use over time. Includes wood products and wild plants collected for their flowers, fruits, or foliage, and animals taken for sport or personal consumption. The cultivation of cranberries and blueberries, the major agricultural crops, is discussed.

Araman, Philip A.

1978. A comparison of four techniques for producing high-grade furniture core material from low-grade yellow-poplar. USDA For. Serv. Res. Pap. NE-429. 7 p.

An economic comparison of different methods of converting low-grade (2A and 2B Common) yellow-poplar lumber into high-grade furniture core material (lumber core). High-grade core material is used in tops, shelves, doors, and drawer fronts and only minor defects are allowed. Three gang-rip first and the conventional crosscut-first manufacturing sequences were evaluated in combination with 1 Common, 2A Common and 2B Common lumber. Results based on costs and yields indicate that 2A and 2B Common lumber and either of two gang-rip first techniques would be the most effective choices.

Araman, Philip A.

1979. To make long character-marked cuttings from low-grade yellow-poplar lumber -- rip first. Int. J. Furniture Res. 1(10):18-21.

Long, character-marked furniture cuttings are easily obtained when low-grade (2A and 2B Common) yellow-poplar lumber is first ripped into strips and then crosscut to remove objectionable defects. Overall yields of character-marked material were 78 percent from 1 Common and 2A Common and 70 percent from 2B Common yellow-poplar lumber. Further, 82 percent of the 1 Common cuttings, 61 percent of the 2A Common cuttings, and 35 percent of the 2B Common cuttings were longer than 50 inches.

Arner, Stanford L., and Donald W. Seegrift.

1979. A computer program for the maximum likelihood estimator of the general multivariate linear model with correlated errors. USDA For. Serv. Gen. Tech. Rep. NE-51. 10 p.

Describes a computer program that obtains maximum likelihood estimates of the parameters for a general linear model with correlated errors. The variates can be a set of different types of variates, repeated measurement on the same variate, or combinations of repeated measurements and different variates. A forest growth and yield model describing repeated measurement of plot volume and basal area is presented.

Auchmoody, L. R.

1978. Response of young black cherry to fertilization. Agron. Abstr. Natl. Meet. Chicago, Ill. 86 p.

Auchmoody, L. R.

1979. Nitrogen fertilization stimulates germination of dormant pin cherry seed. Can. J. For. Res. 9:514-516.

Nitrogen fertilizers triggered germination of dormant Prunus pensylvanica L. seed naturally buried in the forest floor of 60-year-old Allegheny hardwood stands. Neither triple superphosphate nor muriate of potash applied with urea increased germination over that which occurred with urea alone. Rates as low as 56 kg/ha N from urea and calcium nitrate and 112 kg/ha N from ammonium sulfate stimulated germination. Nitrate was apparently responsible for breaking dormancy.

Auchmoody, L. R., and Thomas Greweling.

1979. Problems associated with chemical estimates of biomass. In Impact of intensive harvesting on forest nutrient cycling proceedings. SUNY Coll. Environ. Sci. and For., Syracuse. p. 190-210.

Estimates of the nutrient capital of forest stands include numerous sampling and analytical steps, each of which can introduce variability. The cumulative effect can result in large errors in these estimates. Major sources of error include: (1) Error in biomass predictions; (2) Errors from drawing nonrepresentative samples; and (3) Errors in chemical analyses. Various sampling procedures have been used to estimate nutrient capital, but none has been verified for accuracy.

Auchmoody, L. R., and H. Clay Smith.

1979. Oak soil-site relationships in northwestern West Virginia. USDA For. Serv. Res. Pap. NE-434. 27 p.

An oak soil-site productivity equation was developed for the well-drained, upland soils in the northwestern portion of West Virginia adjacent to the Ohio River. The equation uses five easily measured soil and topographic variables and average precipitation to predict site index. It accounts for 69 percent of the variation in oak site quality and has a standard error of 4.3 feet at the mean site index of 67.6 feet. The equation was tested with data from 61 independent plots, and the results showed a correlation coefficient of 0.83 between predicted and observed site indexes.

Barger, Jack H.

1979. Landing times on various surfaces for Scolytus multistriatus after responding to the pheromone Multilure. J. Econ. Entomol. 72:399-400.

Tests were conducted to determine the length of time that smaller European elm bark beetle remained on various surfaces (landing time) after responding to baits of Multilure, a 3-component pheromone system containing α -cubebene, 4-methyl-3-heptanol, and 2-4-dimethyl-5-ethyl-6, 8-dioxabicyclo (3.2.1) octane (multistriatin). Landing times of beetles on plywood were not affected by the presence of lindane. Beetles remained longer on the boles of American elm, Ulmus americana L., than on non-elm boles.

Barger, Jack H., William N. Cannon, Jr., and David P. Worley.
1978. Spraying and sanitation practices for control of
Dutch elm disease. In Pest management seminar synopsis 79.
Natl. Park Serv., Washington, D. C. p. 101-112.

Elm trees were sprayed with methoxychlor. Bioassays showed that methoxychlor residues persisted and accumulated. The rate of Dutch elm disease (DED) was dramatically lower for the sprayed trees than for the unsprayed controls. An intensive sanitation program featuring frequent disease surveys and prompt removal of diseased elms was found to save more elms at less cost than the more conventional practice that allowed diseased elms to remain standing into the dormant season. A 4-year case history demonstrates savings of 25 percent in total cost and an additional 123 elms per thousand.

Batzer, Harold O., and Daniel T. Jennings.
1979. Persistence of jack pine budworm (Choristoneura pinus pinus (Lepidoptera: Tortricidae)) egg mass chorions on jack pine foliage. Great Lakes Entomol. 12(2):85-86.

More than one-fifth of old and nearly one-half of new jack pine budworm egg-mass chorions remained on the foliage after 1 year, and an experienced observer could not determine accurately the age of one-fourth of them. Counts of new egg masses are used to estimate current populations, and large errors could result.

Baumgras, John E.
1978. The causes of logging truck delays on two West Virginia logging operations. USDA For. Serv. Res. Pap. NE-421. 4 p.

Recording speedometers were used to monitor four logging trucks operating in West Virginia. The causes, frequency, and duration of truck delays and total delay time per shift are reported. Results show that maintenance and repair, administrative actions, and operations scheduling were the leading causes of downtime.

Baumgras, John E., and A. Jeff Martin.
1978. Managing harvesting operations with the Weak Link Logging Systems Analyzer. South. Lumberman 237 (2944):109-115 [Reprinted from The Weak Link Logging Systems Analyzer. 1978. USDA For. Serv. Gen. Tech. Rep. NE-40].

The Weak Link Logging Systems Analyzer is a management tool designed to provide loggers with a means of systematically locating, defining, and analyzing problems encountered in log production. By defining those cost and production items required for a systems analysis, the Weak Link system also can help a logger set up a cost and production accounting system.

Berry, Frederick H.

1978. Chestnut breeding in the United States Department of Agriculture. In Proceedings of the American chestnut symposium. W.Va. Univ. Coll. Agric. and For., Morgantown. p. 39-40.

For many years tree breeders in the U.S. Department of Agriculture crossed the principal chestnut and chinkapin species to produce blight-resistant trees that might be suitable substitutes for the American chestnut for timber and nut production. Results of this work are reported.

Bevins, M. I., T. L. Brown, G. L. Cole, K. J. Hock, M. W. Kottke, W. F. LaPage, R. W. Stammer, and D. J. Stynes.

1979. Changing patterns of outdoor recreation participation in northeastern United States. Univ. Del. Agric. Exp. Stn. Bull. 427. 80 p.

A 1977 telephone survey of adults living in 13 Northeastern States found that 84.5 percent participated in at least 1 of 22 outdoor activities studied. From 1976 to 1977, the number of adults who decreased or stopped their participation exceeded the number who increased it for every activity studied. This deficit was offset by new participants, resulting in net growth for every activity except bicycling, picnicking, and ice skating. Forty-two percent in the sample had adopted a new outdoor activity within the past year. Cross-country skiing, jogging, snowmobiling, recreation vehicle camping, tennis, and canoeing led the list of high-growth activities. During 1976-1977, changes in the location of recreational participation occurred for 61 percent in the sample.

Bevins, Malcolm I., Wilbur F. LaPage, and Daniel P. Wilcox.

1979. The campground industry--recent national trends. USDA For. Serv. Gen. Tech. Rep. NE-53. 41 p.

A comprehensive review of recent trends indicates that the number of campers in the United States is increasing by 1 or 2 percent annually. The supply of public and private campsites has stabilized at approximately 1 million. The small minimal-facility private campground is being replaced by larger convenience oriented resort campgrounds. Industry leaders looking toward 1985 foresee: (1) A slower rate of new campground development; (2) More campgrounds closer to population centers; (3) More full-season campsite rentals; (4) More on-site RV rentals; (5) A slight decrease in Federal campsites; and (6) More public agency use of concession management.

Biller, Cleveland J.

1979. Intermediate supports benefit eastern cable logging systems. For. Ind. 106(9):48-49.

The economics of harvesting an area with and without intermediate supports are discussed with regard to the URUS cable yarding system. These costs are based upon harvesting 661,000 board feet of timber on the Fernow Experimental Forest near Parsons, West Virginia.

Birch, Thomas W., and Douglas S. Powell.

1978. The forest-land owners of Kentucky. USDA For. Serv. Resour. Bull. NE-57. 101 p.

A statistical-analytical report of a mail canvass of the owners of privately owned commercial forest land in Kentucky. The study was conducted in conjunction with the third forest survey of Kentucky by the U.S. Forest Service. Statistical findings are based on responses supplied by owners to a mail questionnaire. Trends in forest-land ownership and the attitudes and intentions of owners regarding reasons for owning forest land, timber management, timber harvesting, recreational use, etc., are discussed.

Bjorkbom, John C.

1979. Seed production and advance regeneration in Allegheny hardwood forests. USDA For. Serv. Res. Pap. NE-435. 10 p.

Studies of the characteristics of seed crops of several Allegheny hardwood species in northwestern Pennsylvania show that good seed crops develop 1 year out of 2 for black cherry, 1 year out of 3 for red maple, and 1 year out of 6 for sugar maple. Flower crops were reliable indicators of seed crop size for the maples but not for black cherry. Seed production was related to advance regeneration and both were related to basal area. Using these data, a guide was devised to evaluate the adequacy of seed sources for the regeneration of Allegheny hardwood stands.

Bjorkbom, John C., L. R. Auchmoody, and Donald E. Dorn.

1979. Influence of fertilizer on seed production in Allegheny hardwood stands. USDA For. Serv. Res. Pap. NE-439. 5 p.

Fertilizers applied in spring can stimulate production of black cherry and red maple seeds in Allegheny hardwood stands. Increased seed production begins in the year after application, but lasts only about 2 years. However, fertilizers do not increase seed production of individual black cherry trees that have a history of poor production, and they do not eliminate seed crop failures, affect seed soundness, or influence the time of seed dispersal.

Bones, James T., and James E. Blyth.

1979. Pulpwood production in the Northeast and North Central States in 1978. North. Logger 28(5):16, 17.

Pulpwood production in the 21 Northeastern and North Central States was 13.2 million cords in 1978, up 3 percent from 1977. Production from residue declined by nearly 7 percent while the roundwood harvest increased by 6 percent. Greater use of residues for energy may be impacting residue availability, especially in the Northern States.

Bones, J. T. and J. K. Sherwood.

1979. Pennsylvania timber industries--a periodic assessment of timber output. USDA For. Serv. Resour. Bull. NE-59. 26 p.

The result of a survey of the timber industries of Pennsylvania, this report contains statistics on industrial timber production and receipts, and production and disposition of the manufacturing residues. Comparisons are made with the most recent previous survey, and trends in industrial wood output are noted.

Bridgen, M. R., J. W. Hanover, and R. C. Wilkinson.

1979. Oleoresin characteristics of eastern white pine seed sources and relationships to weevil resistance. For. Sci. 25:175-183.

Eighty-six 19-year-old eastern white pine trees from a rangewide collection growing in a plantation in southern Maine were analyzed for oleoresin chemical composition and viscosity. Qualitative and quantitative variations in monoterpenes and resin acids were examined for possible relationships between geographic source and resistance to the white-pine weevil. Geographic patterns were found for α -pinene, 3-carene, and terpinolene, but not for the resin acids. Oleoresin viscosity did not differ among provenances. No significant relationships between the oleoresin characteristics and resistance to the insect were detected.

Brush, Robert O.

1978. Managing forests for esthetic benefits. In Urban foresters notebook, Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 4 p.

Reviews the physical characteristics of forests that can be altered through silvicultural practices to elicit a range of esthetic responses by recreationists.

Brush, Robert O.

1979. The attractiveness of woodlands: Perceptions of forest landowners in Massachusetts. For. Sci. 25:495-506.

To discover what private owners of commercial forest land in Massachusetts consider as scenic attributes of woodlands, photographs of 20 sites were shown to individual landowners and to groups of students with and without forestry training. These respondents were asked to rate the attractiveness of each stand, and to complete a checklist of 14 forest features. The data indicated that: (1) Forest-land owners perceive differences in the attractiveness of stands on the basis of certain spatial qualities; (2) Large, enclosed spaces and spaces created by thinning well-stocked stands are more attractive than unbounded openings and dense, overstocked stands; (3) The forestry students agreed with the landowners in their ratings; and (4) Photographs did not accurately represent the attractiveness of the stands.

Brush, Robert O.

1979. Forests can be managed for esthetics: A study of forest-land owners in Massachusetts. In Proceedings of the National Urban Forestry Conference. Nov. 13-16, 1978, Washington, D. C. p. 13-16

A large proportion of forest-land owners in the Northeast derive primarily esthetic and recreational benefits from their property. Yet few of these owners seek out foresters for advice in managing their land. Results of a recent study in Massachusetts show that many owners find managed stands more attractive than unmanaged stands. More private owners might agree to place their woodland under scientific management if they could see how their holdings would appear when managed for a diversity of stand structures.

Brush, R. O., D. N. Williamson, and J. Gy Fabos.

1979. Visual screening potential of forest vegetation. Urban Ecol. 4:207-216.

In areas undergoing urbanization it is often desirable to separate land uses that are not visually compatible, such as major highways from residential districts. Information is needed about the ability of various types of forest to provide a screen, or buffer, between visually incompatible land uses. Measurements taken in deciduous and coniferous stands in summer and winter show that screening is lowest within continuous stands with sparse understory and highest at the edge of the forest where understory vegetation is thick. Management to encourage understory vegetation can improve the screening potential of forested land.

Camosci, D., J. W. Homeyer, and H. M. Mazzone.

1979. Computer analysis for the thermal transition midpoint of DNA. Comput. Biol. Med. 9:155-160.

A programable thermal analyzer system in conjunction with a computer program were used to determine the thermal transition midpoint, T_m , and percentage of guanine plus cytosine, percent G+C, of a bacterial and two viral DNAs. The program uses inputs from a chart digitizer and nonlinear regression to solve for T_m and percent G+C automatically.

Campbell, R. W., L. C. Levitan, E. R. Sobecki, and M. F. Tardiff.

1978. Population dynamics of the gypsy moth: An annotated bibliography. USDA For. Serv. Gen. Tech. Rep. NE-48. 124 p.

Contains 592 references, each dealing with some aspect of the population dynamics of the gypsy moth, Lymantria dispar L.

Canon, Lance Kirkpatrick, Steven Adler, and Raymond E. Leonard.
1979. Factors affecting dispersion of backcountry campsites.
USDA For. Serv. Res. Note NE-276. 6 p.

A study using observational and survey techniques found that no backcountry users fully complied with rules designed to promote campsite dispersion and to avoid recurrent use of particular sites. Users perceived hiking/camping in general, and movement away from established trails in particular, as involving an element of risk. They indicated that convenience was an important determinant of site selection. Increased information about the rules did not decrease the use of previously used sites, but did increase the average distance of chosen campsites from established trails.

Carl, Clayton M., Jr., John R. Donnelly, and Boyd W. Post.
1978. Effects of watering and fertilization on carbohydrate reserves in sugar maple seedlings. USDA For. Serv. Res. Pap. NE-418. 6 p.

Sugar maple seedlings, grown under three nutrient and three moisture levels, were analyzed after three growing seasons for starch and ethanol-soluble sugars. Fertilization did not affect carbohydrate levels in stems or roots. Water stress caused a significant reduction in the amount of carbohydrates in stems and roots.

Ciali, C. P., R. E. Leonard, and J. J. Lindsay.
1978. Collecting hiker information in the backcountry. Univ. Vermont Res. Rep. SNR-RM4. 18 p.

The objective of this study was to determine the feasibility of using trail personnel to collect information from hikers using backcountry hiking trails. Green Mountain Club caretakers and rangers acted as volunteer observer-interviewers on Vermont's Long Trail. Two questionnaires were used to sample day hikers and overnight hikers using trail shelters. Four measures of observer performance were tested: (1) The number of forms completed and sampling percent; (2) Missing data rates; (3) Sample representativeness; and (4) Interobserver reliability. The results indicate that the method is feasible and economical. However, the number of forms completed and the degree of completion varied significantly among individual observers. Observational information was collected more readily than conversational information. The potential use of observation techniques to gather hiker information is discussed and research applications suggested.

Corbett, Edward S.

1978. Disposal of wastewater and sludge in wooded areas. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 9 p.

Rapid population growth, industrial expansion, and urbanization have increased both the demand for water and the problem of meeting the requirements for waste disposal established by Public Law 92-500 (Federal Water Pollution Control Act Amendments of 1972). Wastewater discharged from efficient sewage treatment plants usually meets public health requirements, but it is enriched with nutrients and often contains considerable amounts of synthetic residues. Land application has been proposed as an alternative for renovating wastewater and using sludge. Basic guidelines for establishing land disposal systems are provided and their effect on the forest ecosystem are discussed.

Corbett, Edward S.

1978. Municipal watershed management. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 8 p.

Municipal watersheds have long provided quality water for domestic use, and have generated income from timber production. They are also a source of recreation and esthetic pleasure. Recreational benefits and esthetic considerations are increasingly being incorporated in metropolitan planning studies, and managers of urban resources must consider these aspects of municipal watershed use. Multiple-use management of municipal watersheds is illustrated through case histories. Opportunities for improving water yield and water quality are explained and watershed recreation is discussed.

Corbett, Edward S.

1979. Opportunities in water management. Proc. Soc. Am. For. Annu. Conv. 1978, St. Louis, Mo. p. 185-188.

Intensified forest management is now being practiced to meet the increasing demand for forest products. Shortened rotations, fertilization, whole-tree harvesting, and energy plantations will increase production, but will also increase the stress on soil and water resources. The concept of protecting drinking water supplies through an active source management program is evaluated in relation to contemporary hardwood management practices. Opportunities for making the management and protection of water supply source areas an important aspect of water pollution control planning are discussed.

Corner, Sandy.

1979. Christmas trees: A bibliography. Am. Christmas Tree J. 23(1):17-18, 47.

1979 supplemental listing of published information on the Christmas tree industry.

Cowling, E. B., and L. S. Dochinger.

1979. The changing chemistry of atmospheric deposition and its beneficial and detrimental effects on biological systems. In Proceedings of the 9th conference on environmental toxicology, 28, 29, and 30 March 1979. p. 283-303.

The interception of atmospheric trace elements by biological systems may be beneficial or injurious depending on the chemical composition of ambient constituents, intensity, frequency, and duration of precipitation events, and the genetic and physiological characteristics of the organism upon which atmospheric deposition occurs. In terms of environmental and energy trade-offs, decisions must be resolved with much concern for future impacts of atmospheric deposition on the biosphere.

Craft, Paul E., and John E. Baumgras.

1978. Products derived from thinning two hardwood timber stands in the Appalachians. USDA For. Serv. Res. Pap. NE-422. 8 p.

Two sample plots in Allegheny hardwood poletimber stands were thinned to standards for optimum sawtimber growth. The products available are evaluated and described for weight, volume, diameter, length, and species.

Craft, Paul E., and John E. Baumgras.

1979. Weight and volume yields from thinning two oak-hickory stands. USDA For. Serv. Res. Pap. NE-448. 7 p.

Two sample plots in oak-hickory stands of poletimber-small sawtimber were thinned; one was thinned from 111 ft.² to 53 ft.² of basal area per acre, and one was thinned from 120 ft.² to 84 ft.² of basal area per acre. Products available are classified and described for weight, volume, diameter, length, and species.

Crawford, H. S.

1979. Wildlife and land management. Farmstead Mag. 6(2):56-58.

Variety is the spice of wildlife. Variety in plants and land forms generally ensures variety in wildlife. Like any crop, wildlife is a product of the land, and the landowner can increase or decrease the number and variety of wild animals on his land by the way he manages it. Guidelines for managing small New England farms for wildlife are presented.

Crawford, H. S., W. A. Abler, and D. M. Hardy.

1978. Nesting of birds on strip-mined highwalls in southern West Virginia. Trans. Northeast Sect. Wildl. Soc. p. 87-91.

Strip-mined highwalls in southern West Virginia are not important as nesting sites of birds that prefer to nest on cliffs.

Crawford, H. S., D. M. Hardy, and W. A. Abler.

1978. A survey of bird use of strip-mined areas in southern West Virginia. In Surface mining and fish/wildlife needs in the eastern United States. David E. Samuel, Jay R. Stauffer, Charles H. Hocutt, and William T. Mason, eds. W.Va. Univ. and U.S. Dep. Inter. Fish Wildl. Serv. FWS/OBS-78/81. p. 242-246.

Use by birds of areas mined 3 to 23 years before the study and nearby unmined areas was surveyed in southern West Virginia. The greatest number of bird species was found on unmined areas and on areas mined 8 years earlier. The greatest number of birds was found on areas mined 9 years earlier. Shrub cover with herbaceous ground cover favored high bird populations.

Curtis, Willie R.

1979. Effects of surface mining on hydrology, erosion, and sedimentation in eastern Kentucky. In 4th Kentucky coal refuse disposal and utilization seminar. [June 6-7, 1978, Lexington, Ky.] p. 17-19.

Research by the U.S. Forest Service at Berea, Kentucky, has shown that surface mining results in increases in storm peak flows during and immediately after mining, but that peaks may be significantly lower after reclamation is completed. Impoundments on surface-mine lands can be effective in controlling runoff and erosion provided the ponds are properly constructed. Erosion and subsequent sedimentation are greatest during early stages of mining but diminish rapidly as the land is reclaimed and vegetation growth progresses.

Curtis, Willie R.

1978. Mined land reclamation. Proc. 3rd Natl. Conf. Interagency R&D Program. EPA 600/9-78-022. p. 187-216.

Analysis of coal overburden indicates many of the strata contain adequate plant nutrients except for nitrogen. Wood chips effectively controlled dust on a coal haul road. On sandy acid mine spoils the microbial production of polysaccharides obtained from cellulose degradation contributed significantly to the formation of water-stable aggregates. A hybrid poplar plantation on mine spoil yielded 90 tons of pulpwood and 9,400 board feet of lumber. Black walnut seedlings were established by planting in auger holes backfilled with topsoil.

Curtis, Willie R.

1979. Surface mining and the hydrologic balance. Min. Congr. J. 65(7):35-40.

Data from experimental sites in Breathitt County, Kentucky, and Raleigh County, West Virginia, showed that streamflow from surface-mined watersheds peaked lower than that from adjacent or nearby unmined watersheds. Impoundments on surface-mine lands can be effective in controlling runoff and erosion if the ponds are properly constructed.

Cuthbert, R. A., and J. W. Peacock.

1979. The Forest Service Program for mass trapping Scolytus multistriatus. Entomol. Soc. Am. Bull. 25:105-108.

The aggregation attractant of the smaller European elm bark beetle was used in a trapping test in 1976-77 to determine its effect on populations of S. multistriatus and Dutch elm disease, which these beetles vector. Millions of beetles were captured each year in traps deployed in areas of Evanston, Illinois, and Fort Collins, Colorado, totalling 19,300 ha. The pattern of catches on rows of traps indicates that the barriers of traps were intercepting incoming beetles. Catches on survey traps in Fort Collins were about 80 percent lower than in nearby untreated areas--which suggests a reduction in the abundance of adult beetles. But trapping has not had a significant effect on beetle brood populations or on Dutch elm disease in either city.

Czapowskyj, Mirosław M.

1978. Hybrid poplar on two anthracite coal-mine spoils: 10-year results. USDA For. Serv. Res. Note NE-267. 5 p.

Uprooted dormant cuttings of 28 hybrid poplar clones were planted on two graded anthracite coal-mine spoils derived from sandstone or from glacial till. Ten-year results show that the plantation survived very well (82 percent), but that growth was extremely varied. Spoil characteristics and performance of individual clones are presented.

Czapowskyj, Mirosław M.

1979. Foliar nutrient concentrations in balsam fir as affected by soil drainage and methods of slash disposal. USDA For. Serv. Res. Note NE-278. 4 p.

Foliar nutrient concentrations in young balsam fir growing on strip clearcuts were assessed in relation to soil drainage and three methods of slash disposal. Concentrations of N, K, and Mn were higher for trees growing on well-drained soils than for trees growing on poorly drained soils. Concentrations of Mo were higher on poorly drained soils and all other measured nutrients were unaffected. Only foliar Fe was affected by the three methods of slash disposal.

Czapowskyj, Mirosław M., and Lawrence O. Safford.

1978. Species differ in growth response to fertilizer in a young aspen-birch stand in eastern Maine. Agron. Abstr., p. 187.

Czapowskyj, Mirosław M., and Lawrence O. Safford.

1979. Growth response to fertilizer in a young aspen-birch stand. USDA For. Serv. Res. Note NE-274. 6 p.

A thinned aspen-birch-red maple stand was fertilized with N, P, and N plus P, both with and without lime (L). Overall, treatments with N increased height growth by an average of 79 percent, and volume growth by 69 percent, over treatments without N. Lime tended to increase both average height and volume growth over each corresponding treatment without lime. The amount of growth and the treatment that produced the greatest response differed among species. Bigtooth aspen and paper birch generally responded better than quaking aspen and red maple. Bigtooth aspen and paper birch responded strongly to N and combinations of N and P. Bigtooth aspen was the only species to respond significantly to P alone. Bigtooth aspen trees treated with NP and L grew nearly seven times as much in volume as the control trees. The volume growth of paper birch treated with NL was nearly twice that of the control. Depending on the duration of these growth responses, fertilizer treatment should substantially reduce the time required to produce merchantable size trees, particularly of bigtooth aspen and paper birch. The lesser response by quaking aspen and red maple suggests that fertilization of these species may not be practical.

Davidson, Walter H.

1979. Hybrid poplar pulpwood and lumber from a reclaimed stripmine. USDA For. Serv. Res. Note NE-282. 2 p.

A 2-acre hybrid poplar planting on a reclaimed strip-mine was harvested at age 16. The commercial clearcut yielded 90 tons of pulpwood and 9,400 board feet of lumber. This is equal to a growth rate of approximately 2 cords per acre per year. Selected physical properties of the hybrid poplars were compared with those of other commercial eastern species.

Davidson, Walter H.

1979. Results of tree and shrub plantings on low pH strip-mine banks. For. Serv. Res. Note NE-285. 5 p.

Test plantings were established to evaluate the survival and growth of tree and shrubs on 10 acid strip mines in the bituminous region of Pennsylvania. Included in the test were five species of European alder, four birch species, black locust, sycamore, Scotch pine, autumn olive, sawtooth oak, bristly locust, and Japanese fleecflower. After 11 years, two of the birches had highest rate of survival and best growth overall. On a few plots, European alder from a German seed source performed well. Scotch pine also performed well on a few plots. In general, survival and growth of all species was poor on spoils where the pH was less than 3.5.

Davis, Weston, Alex Shigo, and Richard Weyrick.

1979. Seasonal changes in electrical resistance of inner bark in red oak, red maple, and eastern white pine. For. Sci. 25:282-286.

Electrical resistance of inner bark in Acer rubrum, Quercus rubra, and Pinus strobus recorded from March to December 1977, in New Hampshire was lowest in June and July, and increased in September and October. January and February data were not used because some inner bark tissues were frozen. The seasonal electrical resistance patterns of the three species were similar.

DeBald, Paul S.

1979. Economics of even-age regimes in northern hardwoods. In Economic forum on forest-land ownership, management and investment. Proc. Soc. Am. For. Wis.-Mich. Sect. Meet. [March 9-10, Marquette, Mich.] p. 155-165.

Practitioners often must make strategic management choices subjectively and without the benefit of tested expert opinion. This paper: (1) Describes an approach for evaluating even-age management possibilities in northern hardwoods, using imperfect tools, incomplete information, and personal judgments; (2) Stresses the importance of subjective choices; and (3) Makes a plea for researchers to share their expert opinions with practitioners.

DeGraaf, R. M.

1978. Avian communities and habitat associations in cities and suburbs. In Wildlife and people. Purdue Univ. Dep. For. Nat. Res. p. 7-24.

Bird communities of urban and suburban habitats were substantially different both in the breeding season and in winter. The suburban habitat had 50 species in the breeding season, compared with 15 urban species. In winter, 27 species were found in the suburbs, compared with 19 urban species. The city had more wintering than breeding species. Total breeding bird density was about three times greater in the city and over two times greater in winter than suburban bird densities, a result caused by high numbers of exotic species in the city. In the suburbs, tree and shrub variables were most strongly related to bird density; in the city, distance to the nearest woodlot was the most important determinant of bird density.

DeGraaf, Richard M.

1978. House-lot landscaping for wildlife. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 8 p.

The value of residential properties as wildlife habitats can be greatly increased through the proper selection and arrangement of vegetation. Following a plan of the property, the site requirements of trees, shrubs, and vines can be met so that they develop fully to provide cover and nest sites and variety of foods. Species that provide dense nest cover and that bear fruit that persists throughout the winter are especially valuable. Providing a source of water will add greatly to the backyard habitat.

DeGraaf, Richard M.

1978. Management of wooded areas for songbirds and other wildlife. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Management of urban wooded open spaces for birds and other wildlife can often be made more effective by reducing "grooming" and landscaping efforts. Wildlife management is best applied in larger stands, where human disturbance is generally less prevalent and where there are a greater diversity of habitat types. Specific management practices include leaving dead or dying trees, both in the stand interior and on the edge, especially in a shrubby tangled edge along the back of a pond or wet site. Cavity nesting species, most of which are insectivorous, are notably lacking in urban forests, and the provision of dead trees will help encourage their occurrence. For breeding birds, management efforts should be directed at providing habitat security--the use of thorny hedges and a dense understory (for ground-nesters) should discourage human intruders near nesting birds, but allow viewing from walks or trails.

DeGraaf, Richard M., and David G. Holland.

1978. Response of breeding birds to gypsy moth defoliation of an upland oak habitat. Trans. Northeast Sect. Wildl. Soc. p. 105-119.

Results of a 2-year breeding bird census in defoliated and control tracts in a central Pennsylvania oak forest revealed dramatic differences for 7 of 36 bird species present. The occurrences of the great crested flycatcher, black-capped chickadee, worm-eating warbler, and red-eyed vireo were significantly greater in the control tract. Occurrences of the yellow-billed cuckoo, common yellowthroat, and rufous-sided towhee were significantly greater in the defoliated tract. Among nesting guilds, the mean frequencies of occurrence of ground nesters were significantly greater in the defoliated tract.

DeGraaf, R. M., and G. M. Witman.

1979. Trees, shrubs and vines for attracting birds. A manual for the Northeast. Univ. Mass. Press, Amherst. 194 p.

Describes the site requirements, flowering and fruiting times, landscape uses, habitats, and propagation methods for 163 woody plants that are useful for attracting birds in the Northeast. Bird uses included are the plants' value for food, nesting, and cover. Basic principles of plantings to attract birds and a sample design are included.

Demeritt, M.E.

1979. Poplar culture in the Northeast. Proc. Annu. Meet. North Am. Poplar Counc. p. 27-30.

Demeritt, Maurice E.

1979. Evaluation of early growth among hybrid poplar clonal tests in the Northeastern United States. 26th Northeast. For. Tree Improv. Conf. Proc. p. 133-139.

It is possible to select a few hybrid poplar clones that grow well on a number of sites. However, coefficients of rank correlation between locations are not large enough to warrant early selection of a large number of clones for planting over large regions. Full-sib family data indicate that family selection followed by mass selection and clonal propagation should be considered as an alternate improvement method following any further hybridization efforts with Populus species.

Demeritt, Maurice E., Jr., W. Thomas Adams, and Robert J. Joly.

1979. Preliminary results of competition among hybrid poplar clones. 26th Northeast. For. Tree Improv. Conf. Proc. p.179-183.

The effects of intergenotypic competition on the growth of hybrid poplar clones established from unrooted cuttings were investigated. Results based on experimental plot means in a greenhouse study indicate that competitive interactions are of minor importance in their effect on early growth. Initial cutting weight was an important determinant of early growth.

Dochinger, Leon S., Keith F. Jensen, and Roy Patton.

1978. Effects of air pollution on trees. In Urban foresters notebook. Silas Little, ed. USDA For. serv. Gen. Tech. Rep. NE-49. 3 p.

Air pollutants may be both beneficial and injurious to trees, either directly, by affecting biomass processes at the cellular level, or indirectly, by influencing biological and chemical activities in the plant community. Eventually, the response of woody vegetation to air pollution is a decrease in plant growth and yield at both the organism and community levels.

Dochinger, Leon S., Keith F. Jensen, and Roy Patton.

1978. Trees and woodlands reduce air pollution. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 4 p.

Recent studies have demonstrated that trees have the potential to remove pollutants from the atmosphere. Particles are deposited on vegetation by sedimentation due to gravity, impaction due to aerodynamics, and deposition due to precipitation. Gaseous compounds are removed primarily by uptake through the stomata. Woodland plantings cannot completely solve the air pollution problem, but may contribute substantially to a solution.

Dochinger, Leon S., and Alden M. Townsend.

1979. Effects of roadside deicer salts and ozone on red maple progenies. Environ. Pollut. 19(3):229-237.

Significant differences were found among three red maple progenies in height growth response to salt, to ozone, and to salt and ozone combined. Seedlings from a Maine seed source showed the lowest degree of foliar injury in response to all treatments and were also least suppressed in total height growth. Demonstrated genetic tolerance or susceptibility of red maple to ozone and salt supports the validity of selection programs for trees capable of withstanding pollution-related stresses.

Donley, David E.

1978. Distribution of the white oak borer in a mixed oak stand. Proc. 2nd Cent. Hardwoods For. Conf., P.E. Pope, ed. p. 529-539.

The white oak borer Goes tigrinus DeGeer infested white oaks (Quercus alba L.) in a strip 50 to 100 feet wide in a 3.4-acre mixed stand studied for 5 years. Most borer damage was in the 4- to 9-inch diameter classes. Borers preferred to attack the fastest growing trees and ones that had been attacked before. Female borers preferred oviposition sites at a diameter of 4.3 inches. This information facilitates control of borer damage by removal of infested trees.

Dubois, N. R., H. B. Gunner, and R. A. Daoust.

1979. Effect of chitinase on the peritrophic membrane of Lymantria dispar L. (Lepidoptera: Lymantriidae) larvae. J. N.Y. Entomol. Soc. 86:285.

Duchacek, Howard.

1978. Tubular versus standard evaporator. Natl. Maple Syrup Dig. 18(2):15-18.

Tests of the standard fin or flue type maple sap evaporator and a newly designed tubular (inclined-tube) maple sap evaporator indicated that the tubular design, as compared to the standard evaporator, could increase evaporation efficiency by about 7 percent. The production rate for a tubular unit of the same size as a standard evaporator should be at least 10 percent greater with the same amount of fuel.

Duchacek, Howard, Frederick M. Laing, Lawrence D. Garrett, Neil K. Huyler, Mariafranca Morselli, and James Marvin.

1978. Sap preheaters: Efficient maple syrup processing. Univ. Vt. Agric. Exp. Stn. MP 97. 11 p.

A parallel flow preheater prototype was designed and tested for use as an integral part of a maple syrup evaporator hood or for installation within existing hoods. The sap preheater produced an outlet sap temperature at the regulator box of approximately 190-200° F., increased evaporator efficiency by 15 percent, and provided needed hot water to the plant operator. The system will reduce processing costs by approximately 6 percent and reduce total costs associated with the manufacture of maple syrup by about 3 percent.

Echelberger, Herbert E., Raymond E. Leonard, and Marysewall Lindsey Hamblin.

1978. The trail guide system as a backcountry management tool. USDA For. Serv. Res. Note NE-266. 5 p.

A trail guide booklet containing a map, directional and distance data, and information about the natural and human history and management problems of a backcountry hiking trail was keyed to small, numbered, wooden markers along the trail. This system, evaluated on an 8-mile loop in the White Mountain National Forest in New Hampshire, may be useful for contacting backcountry recreationists and gaining their interest and cooperation.

Echelberger, Herbert E., and Silas Little.

1979. Wooded areas managed for intensive recreation. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Addresses the types of issues urban foresters should consider in planning, construction, and management of wooded areas for urban recreational use. Topics are discussed in a general, rather than prescriptive fashion. For example, planning and construction need to reflect current technological progress so that management can be as flexible as possible. Options for hardening sites, as well as rotating their use, should not be foreclosed. Remedial measures for coping with uses that exceed designed capacity are discussed.

Eckstein, Dieter, Walter Liese, and Alex L. Shigo.

1979. Relationship of wood structure to compartmentalization of discolored wood in hybrid poplar. Can. J. For. Res. 9: 205-210.

Xylem in hybrid trees (Populus deltoides Marsh X P. trichocarpa Hook) that had small columns of discolored wood associated with wounds (strong compartmentalization) was different from xylem in trees that had large columns (weak compartmentalization). Vessel systems had the most obvious differences. Strong-compartmentalizing trees had fewer and smaller vessels with fewer connections to other vessels than the weak-compartmentalizing trees. These anatomical differences may aid in selecting, at an early age, strong-compartmentalizing trees resistant to defects.

Ernst, Richard L., and David A. Marquis.

1979. Tree grade distribution in Allegheny hardwoods. USDA For. Serv. Res. Note NE-275. 5 p.

Estimates of the distribution of tree grades by diameter class were developed for six hardwood species on the Allegheny Plateau. These estimates can be used to calculate present and projected stand values when actual tree-grade measurements are not available.

Fay, Stephen C., and Raymond E. Leonard.

1979. Composting privy wastes at recreation sites. *Compost Sci.* 20(1):36-39.

Disposing of human waste at remote overnight shelter sites located over soils unsuitable for waste filtration has posed a need for an alternative facility to the pit privy. Bin composting is an economical and practical way to decompose privy wastes. One bin composter can handle wastes generated by up to 70 persons per week and is independent of the site's physical condition.

Federer, C. Anthony, and Douglas Lash.

1978. BROOK: A hydrologic simulation model for eastern forests. *Water Resour. Res. Cent., Univ. N.H. Res. Rep.* 19. 84 p.

Federer, C. Anthony, and Douglas Lash.

1978. Simulated streamflow response to possible differences in transpiration among species of hardwood trees. *Water Resour. Res.* 14:1089-1097.

Species of hardwood trees differ in the timing of leaf development in spring, color change in autumn, distribution of roots, and resistance of leaves to water loss. A hydrologic model, called BROOK, was used to simulate the effect of these differences on streamflow. Extreme variation in each of the differences caused mean annual streamflow to vary less than 48 mm or about 10 percent for eastern hardwood forests. The differences were concentrated in the summer for shallow glaciated soils but were spread through the year for deep residual soils. Identification of and management for species that produce the most streamflow does not seem worthwhile.

Federer, C. A.

1979. A soil-plant-atmosphere model for transpiration and availability of soil water. *Water Resour. Res.* 15:555-562.

A transpiration model simulated plant-water potential and stomatal behavior in a hardwood forest, both within a day and over a summer. The model showed how, even in wet soil, high flow resistance within trees can cause stomata to close, thus reducing transpiration. In drying soil, water uptake was limited by decreasing soil-water potential rather than decreasing water movement to the roots.

Fisher, Edward L., and Harry G. Gibson.

1979. Helicopter logging moves East--trial results.

Trans. of the ASAE 22(1):13-15, 20, illus. [Reprinted from
Am. Soc. Agric. Eng. 58(8):17-18, 1977] .

Frank, Robert M., and Barton M. Blum.

1978. The selection system of silviculture in spruce-fir stands--
procedures. Early results, and comparisons with unmanaged stands.
USDA For. Serv. Res. Pap. NE-425. 15 p.

Early results after 20 years of record keeping indicate that spruce-fir stands will respond to the selection system of silviculture. Stand quality is improved, species composition can be altered, diameter-class distribution approaches a stated goal, stand density is controlled, and yields are increased. Selection silviculture in spruce-fir can now be compared to early results from unregulated harvesting (commercial clearcutting) and no management for wood products (woodland preserve or wilderness). Lack of direct comparisons between selection silvicultural management and no management in spruce-fir stands has been partly responsible for the limited acceptance of the method.

Gabriel, William J.

1979. Early flowering and seed production in plantations of
sugar maple. Tree Plant. Notes 30(3):11-13.

Observations were made of early flowering and seed production of sugar maples in one plantation of graft origin and two plantations of seedling origin. While heavy flowering occurred early among grafts, the production of seed was relatively light. Trees of seedling origin were still in their juvenile stage, with respect to flowering, after 21 growing seasons.

Gabriel, William J.

1979. Sweeter sugar maples. N.H. For. Notes 136:27-28.

Genetic experiments to improve the sap sweetness of sugar maples have progressed into the progeny testing phase. Progenies from 53 trees, selected for superior sap sugar production in the six largest syrup-producing states in the Northeast, are being tested in out-plantings replicated in Vermont, Ohio, Pennsylvania, and Michigan. All selections have been moved into a centrally located clonal bank through grafting and have already produced a heavy crop of flowers. Roguing of clones not genetically superior will be based on progeny test results. Early assessments may be possible by mini-tapping seedlings.

Galford, Jimmy R.

1979. Preliminary test on booby-trapping for control of two cerambycids. For. Serv. Res. Note NE-284. 3 p.

Small aluminum "boats" containing cotton saturated with lindane were glued to elytra of female red oak borers and locust borers and the beetles released into cages or onto trees. Males attempting to mate with booby trapped females contacted the insecticide and died. However, females also became contaminated in mating attempts and soon died.

Galoch, E., and M. Michniewicz.

1978. Dynamics of endogenous gibberellin-like substances in embryonic shoots of young Scots pines (Pinus silvestris L.) at the time of flower primordia initiation. Bull. Acad. Pol. Sci., Ser. Biol. 26:421-424. (PL-480 Proj. PL-FS-63 in Torun, Poland, in cooperation with J. A. Romberger).

When Scotch pines begin flowering at about 15 years of age, there is a general increase in gibberellin-like substances that are extractable from the buds. There are also changes in the within-season dynamics of these substances. As the increases in gibberellin-like substances are much greater in male than in female buds, it is likely that these "hormones" are related to sex determination in Scotch pine.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19), Beltsville, Md. 20705.

Galoch, E., M. Michniewicz, and Z. Zatorska.

1978. Dynamics of plant hormones in the shoots of flowering and not yet flowering young Scots pines (Pinus silvestris L.) Bull. Acad. Pol. Sci., Ser. Biol. 26:283-287. (PL-480 Proj. PL-FS-63 in Torun, Poland, in cooperation with J. A. Romberger.)

From a natural stand of 12- to 14-year-old Scotch pines two groups of experimental trees were selected: those that had begun to flower and those that had not. Birds at six stages of development were collected from each group. Auxins, gibberellins, and abscisin-type growth inhibitors were extracted from the buds and assayed. The buds of flowering pines, as compared with the nonflowering group, were higher in gibberellins and lower in auxins. The amounts of abscisin-type inhibitors were not related to flowering status. These results agree with the hypothesis that gibberellin-type "hormones" are involved in floral determination.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19), Beltsville, Md. 20705.

Gansner, David A., and Owen W. Herrick.

1979. Forest stand losses to gypsy moth in the Poconos. USDA For. Serv. Res. Note NE-273. 5 p.

A study of forest stand losses associated with the gypsy moth outbreak of the early 1970's in the Pocono Mountain Region of northeastern Pennsylvania showed that while most of the stands incurred little or no loss, a few suffered heavy damage.

Garrett, Lawrence D.

1979. Determining wood fuel costs and economic use in home heating systems. In 4th wood heating seminar proceedings. Wood Energy Inst., Camden, Maine. p. 286-309.

Details the economic implications of using wood as an energy source in home heaters. Specifically, it characterizes those variables that affect the net energy yield to be realized from wood as a fuel.

Garrett, Peter W.

1979. Species hybridization in the genus Pinus. USDA For. Serv. Res. Pap. NE-436. 17 p.

Results of a breeding program in which a large number of pine species were tested indicate that a number of species and hybrids may be useful in the Northeastern United States. Austrian black pine x Japanese black pine and hybrids containing Japanese red pine all had good growth rates. While none of the soft pines grew faster than eastern white pine, a number of hybrids grew equally fast, and the non-native component in the crosses may provide pest resistance, which is the number one problem in the Northeast.

Garrett, P. W., W. K. Randall, A. L. Shigo, and W. C. Shortle.

1979. Inheritance of compartmentalization of wounds in sweetgum (Liquidambar styraciflua L.) and eastern cottonwood (Populus deltoides Bartr.). USDA For. Serv. Res. Pap. NE-443.

Studies of half-sib progeny tests of sweetgum (Liquidambar styraciflua) and clonal plantings of eastern cottonwood (Populus deltoides) in Mississippi indicate that both the rate of wound closure and size of discolored columns associated with the wounds are heritable traits. Both are independent of stem diameter, which was used as a measure of tree vigor in these studies. Selection for rate of closure would not be useful, but selection for compartmentalization of discoloration and decay resulting from wounding would be valuable in forest and amenity trees, and could be applied immediately to existing improvement programs for these species.

Gatchell, Charles J., Hugh W. Reynolds, and Philip A. Araman.
1979. Furniture parts from small logs--at a
profit. Proc. 7th Annu. Hardwood Symp. Hardwood Res. Counc.
Cashiers, N.C. p. 35-43.

Millions of acres in the hardwood region of the East contain trees 7 to 12 inches in diameter that are uneconomical to process with conventional procedures. A new approach with profit potential based on processing standing timber for specific end products seems to hold high promise. A key to the success of this approach is the degree of commonality of part sizes that exists in different kinds of furniture. Research on parts commonality, Serpentine end matching for parts length, and System 6 for short log conversion is summarized along with a marketing approach for low-grade hardwoods.

Gochenour, Donald L., Jr., Edward L. Fisher, and Cleveland J. Biller.
1978. An analytical appraisal of cable logging technique in
Appalachia. For. Ind. 105(11):80-84.

Overhead cable logging has advantages on the steep slopes of the Appalachians. A small European standing skyline was tested for partial cutting of hardwood stands and proved effective. Damage to the site and residual stand was minimal. The cost of yarding logs to the landing averaged \$72 per thousand board feet (International 1/4 inch rule). The effect of training is discussed through comparison of corridors harvested early in the test with those logged toward the end, nearly 1 year later.

Godin, Victor B., and Raymond E. Leonard.
1979. Management problems in designated wilderness areas. J.
Soil & Water Conserv. 34(3):141-143.

The Wilderness Act of 1964 designated a unique system of public lands. Managers of these wilderness areas face a number of problems. Some are common to backcountry regions throughout the country; others are peculiar to the management of these specially designated areas. We surveyed managers of 63 of the 125 officially designated wilderness areas (as of January 1975). Traditionally, researchers have questioned backcountry and wilderness visitors to ascertain their views. We directed our questionnaire to wilderness managers to determine management's views on operating and controlling forest resources and to determine what these managers perceived as their most important operating problems. Only one problem--site deterioration--was cited by more than half the respondents. Seven other problem areas were identified. The wilderness managers' perceptions of their severity varied from location to location.

Godman, Richard M., and Joseph J. Mendel.

1978. Economic values for growth and grade change of sugar maple in the Lake States. USDA For. Serv. Res. Pap. NC-155. 16 p.

Current and expected rates of value increase over a 10-year period were developed for sawtimber-size sugar maple based on variable growth rates, expected merchantable height changes, and butt log grade improvement. These economic guides, along with silvicultural considerations, provide a value basis for selecting trees during thinning and determining final harvest size.

Godwin, Paul A., and Thomas M. O'Dell.

1979. A laboratory study of the interaction of two parasites of Lymantria dispar (Lep.:Lymantriidae): Blepharipa pratensis (Dipt.: Tachinidae) and Brachymeria intermedia (Hym.:Chalcididae). Entomophaga 24(2):185-190.

The interaction between Blepharipa pratensis (Meigen) and Brachymeria intermedia (Nees) was investigated in the laboratory to determine whether B. intermedia attacked gypsy moth pupae already infected by B. pratensis. B. intermedia did attack infected pupae but rarely killed the B. pratensis maggot. There was some evidence that B. intermedia can detect pratensis-infected gypsy moth pupae.

Graber, R. E.

1979. Chip-harvesting on short rotations--its effect on natural regeneration. In Impact of intensive harvesting on forest nutrient cycling proceedings. SUNY Coll. Environ. Sci. and For., Syracuse. p. 395.

Graves, P. F., and W. F. LaPage.

1978. Participant satisfaction with public involvement in U.S. Forest Service recreation policy. In Involvement and environment: Proceedings of the Canadian conference on public participation. [October 1977, Banff, Alberta] p. 297-311.

Summarizes the major findings from a study of public involvement in developing recreation management policies of the White Mountain and Green Mountain National Forests in northern New England. Compares participant satisfaction with the final policies and participant confidence in the agency among three kinds (intensities) of involvement in the process of policy formulation.

Greenleaf, R. D., and W. F. LaPage.

1979. Recreation in the forestry curriculum--observations. In Recreation resource management and the professional forester. Proc. Am. For. Recreation Work. Group Tech. Sess. [October 1978, St. Louis, Mo.] p. 412-415.

Focuses on undergraduate recreation education training for foresters. In the spring of 1978, two surveys on forest recreation education training were conducted by the SAF Recreation Working Group. A questionnaire was sent to Working Group members concerning their perceptions of the adequacy of their own forest recreation training and that of recent forestry school

graduates. Also, heads of SAF accredited schools of forestry were surveyed to document existing requirements and opportunities in forest recreation training at their schools.

Gregory, Garold F., and James R. Allison.

1979. The comparative effectiveness of pruning versus pruning plus injection of trunk and/or limb for therapy of Dutch elm disease in American elms. J. Arboric. 5(1):1-4.

In 1976, American elm street trees infected with Dutch elm disease in Elmhurst, Illinois, and Shaker Heights, Ohio, were given one of the following treatments: (1) pruning; (2) limb injection with Lignasan BLP and pruning; (3) trunk injection with Lignasan BLP and pruning; or (4) trunk and limb injections and pruning. Trees with wilt symptoms greater than 30 percent when discovered were not treated but removed as soon as possible. By the end of 1977, Treatment 4 seemed the most effective, followed by Treatment 3. The superiority of Treatments 3 and 4 was particularly evident when symptoms at time of treatment were 10 or 15 percent.

Gregory, Robert, and William Wallner.

1979. Histological relationship of Phytobia setosa to Acer saccharum. Can. J. Bot. 57:403-407.

The maple cambium minor, Phytobia setosa (Loew), attacks Acer spp., producing ray flecks which result in degrade in face veneer and furniture wood. Samples from infested sugar maple, Acer saccharum Marsh, trees demonstrated that while mines passed close to the vascular cambium, the initial cells were not affected. Thus, although it is called a cambium minor, it does not mine the cambium. Mines filled with parenchyma cells which proliferated from severed vascular rays. These cells, when mature, stored starch. In heavily infested trees, the starch storage area in the xylem may thus be measurably increased. The zone of newly differentiating xylem provides the insect with the path of least resistance; variation in the condition of secondary xylem may account for the variability in host susceptibility.

Halverson, Howard G., and James L. Smith.

1979. Solar radiation as a forest management tool: A primer of principles and application. USDA For. Serv. Gen. Tech. Rep. PSW-33. 13 p.

Forests are products of solar radiation use. The sun also drives the hydrologic cycle on forested watersheds. Some basic concepts of climatology and solar radiation are summarized, including earth-sun relations, polar tilt, solar energy, terrestrial energy, energy balance, and local energy. An example shows how these principles can be applied in resource management. This paper is designed to be used with an earlier report on controlling solar light and heat in a forest by managing shadow sources.

Hanks, Leland F.

1979. Cubic-foot tree volumes and product recoveries for eastern redcedar in the Ozarks. USDA For. Serv. Res. Note NE-283. 4 p.

Tree volume tables and equations for eastern redcedar are presented for gross volume, cant volume, and volume of sawmill residue. These volumes, when multiplied by the average value per cubic foot of cants and residue, provide a way to estimate tree value.

Hanks, Leland F.

1979. Hardwood tree grading for factory lumber. Timber Process. Ind. 4(10):43-45.

The hardwood tree grades provide a way for timber buyers and sellers to separate sawtimber trees by quality. Tree grading is broken down into a step-wise procedure during which the grader considers the tree's size, surface, straightness, and soundness. Lumber grade yields accompany the tree grades, and, when coupled with lumber value, tree value can be predicted.

Hanks, Leland F., and Robert L. Brisbin.

1978. Lumber grade yields for graded aspen logs and trees. USDA For. Serv. Res. Pap. NE-423. 13 p.

Green lumber grade yields for aspen were determined for use with the Forest Service hardwood log and tree grades. The yields for logs are expressed in percent of total lumber tally volume and those for trees are expressed in board feet. Overruns for the International 1/4-inch and Scribner log rules along with lumber recovery factors are shown by log grade.

Healy, William M.

1978. Wild turkey winter habitat in West Virginia cherry-maple forests. Trans. 34th Northeast Fish and Wildl. Conf. p. 7-12.

During three winters, vegetation and site characteristics were measured along trails left in the snow by turkeys (Meleagris gallopavo). The study site was a 52-km² area of black cherry-sugar maple forest that is typical of about half of West Virginia's turkey range. Feeding sites were associated with seeps, southern exposure, lower slopes, and sawtimber. Seeps with the greatest potential value had a permanent flow, diffuse outlet, and much substrate. In cherry-maple forests, wildl turkey management should be directed toward identifying areas with high potential value for winter range, and maintaining black cherry (Prunus serotina) as a dominant tree species.

Heisler, Gordon M.

1978. Effects of trees and woodlands on microclimate and home conditioning costs. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Heisler, Gordon M., David T. Harrje, and Charles E. Buckley.
1979. Planning the arrangement of tree windbreaks for reducing air infiltration energy losses. Preprint 14th Conf. Agric. and For. Meteorol. and 4th Conf. Biometeorol. Am. Meteorol. Soc., Boston, Mass. p. 123-125.

Tree windbreaks reduce energy requirements for space heating of small buildings primarily by reducing wind-induced infiltration of cold outside air. In a wind tunnel study, measured pressure distributions on a model house were used to calculate an index of infiltration for comparing windbreaks. Tree models were wire frames wrapped with yarn. The house-to-windbreak distance for maximum windbreak effectiveness was three times windbreak height. Double rows were 30 percent more effective and triple rows 57 percent more effective than single rows. Staggered rows were 12 percent more effective than nonstaggered rows.

Hejnowicz, Z., and J. A. Romberger.
1979. The common basis of wood grain figures is the systematically changing orientation of cambial fusiform cells. Wood Sci. & Tech. 13:89-96.

Wavy or "curly" grain, the striped figures on radial surfaces of interlocked grain wood, and even moire or checkered figures, all result from systematically changing alignment of cells within the cambium. Such changing of alignments or orientations is the visible aspect of morphogenic wave phenomena that determine the direction (rightward or leftward) of certain cell divisions. Such locally nonrandom orientation of divisions and nonrandom intrusive growth of new daughter cells leads to local changes in grain inclination. The morphogenic waves and the visible grain inclination "waves" migrate along the stem--about one wavelength in 10 to 15 years. Wood grain waves and related grain patterns are automatic and permanent recordings of the existence and movements of morphogenic waves in the cambium. The nature of these waves is not understood.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19), Beltsville, MD 20705.

Herrick, Owen W., David A. Gansner, and Paul S. DeBald.
1979. Predicting stand losses from the gypsy moth: An application of automatic interaction detection. J. For. 77:91-94.

Among 59 forest stand characteristics examined, the foremost discriminators of tree mortality hazard from defoliation by the gypsy moth, Lymantria dispar L., were crown condition, elevation, tree-size distribution, species, and position on slope.

Herrington, Lee P.

1978. Trees modify noise levels. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Hilt, Donald E.

1979. Diameter growth of upland oaks after thinning. USDA For. Serv. Res. Pap. NE-437. 12 p.

Diameter growth rates of the 40 largest trees per acre on 154 plots in Kentucky, Ohio, Missouri, and Iowa were analyzed to determine the effects of thinning on upland oak stands. Thinning increased the diameter growth of the residual trees, regardless of age or site. The heavier the thinning, the greater the response. Diameter growth rates and growth response after thinning, relative to a control, were better in younger stands. Growth rates were higher on better sites, but the growth response relative to a control was not influenced much by site. In most instances, the largest 40 trees per acre responded as well or better to thinning than the second 40 largest.

Hilt, Donald E., and Martin E. Dale.

1979. Stem form change in upland oaks after thinning. USDA For. Serv. Res. Pap. NE-433. 7 p.

Results of two independent studies were analyzed to determine whether residual stocking after thinning had any effect on change in stem form of upland oak. Neither study showed significant differences in changes in stem form that could be related to residual stocking. The change in stem form was significantly correlated with the initial form for all stocking levels. Trees with the best form were more likely to deteriorate in form while the poorly formed trees were most likely to improve, regardless of the residual stocking level.

Hornbeck, James, and William Kropelin.

1979. Nutrient removal and leaching losses from a whole-tree harvest of northern hardwoods. In Impact of intensive harvesting on forest nutrient cycling proceedings. SUNY Coll. Environ. Sci. and For., Syracuse. p. 397.

Hornbeck, James W., Michael T. Koterba, and Robert S. Pierce.

1979. Sludge application to a northern hardwood forest in New Hampshire: Potential for dual benefits? In Utilization of municipal sewage effluent and sludge on forest and disturbed land. William E. Sopper and Songa N. Kerr, eds. Pa. State Univ. Press, University Park. p. 137-144.

Sludge from a sewage treatment plant at Plymouth, New Hampshire, was applied to the floor of a northern hardwood stand at rates of 25 and 125 t/ha. The light application did not cause detectable changes in the chemistry of soil solution, while the heavier application caused increases in most of the major elements found in soil solution. An intermediate rate between 25 and 125 t/ha applied well away from stream channels should not have harmful impacts on streamwater chemistry.

Hornbeck, J. W., and S. J. Ursic.

1979. Intensive harvest and forest streams: Are they compatible?
In Impact of intensive harvesting on forest nutrient cycling
proceedings. SUNY Coll. Environ. Sci. and For., Syracuse. p.
249-262.

Intensive harvest will not harm forest streams if the channel is protected and left shaded and care is taken in logging. After intensive harvest there will be: (1) An increase in water yield and stormflow that will persist at a declining rate for about 5 years after harvest; (2) An increase in sediment load; and (3) An elevation in nutrient concentrations, depending on soil and site factors. Treatments such as site preparation, fertilization, and short rotations will add to the impacts of intensive harvest and must be carefully evaluated.

Horsley, Stephen B.

1978. Chemicals from herbaceous plants maintain forest openings.
Pa. For. 68(4):12-13, 24.

Many treeless or nearly treeless forest openings developed on the Allegheny Plateau following turn-of-the-century cuttings, fires, and deer browsing. These openings now contain a dense groundcover of fern, grass, goldenrod, and aster and have failed to regenerate for 50 or more years. Studies of the reasons for persistence of these forest openings suggest that biochemical toxins released from the foliage and roots of the herbaceous plants interfere with tree seedling growth.

Horsley, Stephen B.

1979. Herbicide treatment of fern and grass understories with Roundup: A new tool in Allegheny hardwood silviculture.
Allegheny News, Summer. 2 p.

Houseweart, Mark W., Daniel T. Jennings, and James C. Rea.

1979. Large capacity pitfall trap. Entomol. News 90(1):51-54.

Describes materials, procedures, advantages, and disadvantages of using large capacity pitfall traps to inventory ground-dwelling fauna in spruce-fir forests.

Houston, David R.

1979. Classifying forest susceptibility to gypsy moth defoliation.
U.S. Dep. Agric., Agric. Handb. 542. 23 p.

Describes, in pictures and words, the nature of forest stands in New England known to be resistant or susceptible to the gypsy moth. An approach is presented that employs principal component analysis "models" to classify stand susceptibility.

Houston, David R.

1979. Spreading tree diseases: The hand of man. *Ecologist* 4/5:120-124.

Our actions today may greatly affect the quality of our forests in the future. This paper points out the various ways that people have influenced the spread and development of three tree disease complexes--beech bark disease, oak decline, and basal canker of white pine.

Houston, D. R., E. J. Parker, and D. Lonsdale.

1979. Beech bark disease: Patterns of spread and development of the initiating agent, Cryptococcus fagisuga. *Can. J. For. Res.* 9(3):336-344.

Beech bark disease occurs when beech trees, predisposed by infestation of the beech scale (Cryptococcus fagi(Baer.))m are infected by species of the fungal genus, Nectria. Infestation patterns of C. fagi on individual trees and in forest stands were studied. Fagus sylvatica L. was infested artificially with C. fagi. After 3 years, secondary colonization on individual trees was generally restricted to within 1 m from points of introduction. C. fagi was associated positively with the bark lichen, Lecanora conizaeoides Nye ex Cromb., and negatively with the bark fungus, Ascodichaena rugosa Butin. In a young plantation, patterns of scale infestation were related to distance from a large old relic tree and to wind direction records for the insect's dispersal period. In another plantation, the infestation patterns were associated with site topography.

Houston, D. R., E. J. Parker, R. Perrin, and K. J. Lang.

1979. Beech bark disease: A comparison of the disease in North America, Great Britain, France, and Germany. *Eur. J. For. Pathol.* 9:199-211.

Beech bark disease is an often lethal malady of Fagus sylvatica and F. grandifolia. Observations in North America and recent studies in Great Britain and France support the concept that the disease complex occurs when bark, infested by the scale insect Cryptococcus fagi, is infected and killed by fungi of the genus Nectria. Comparisons of the ecology of beech bark disease, borne out by recent investigations in North America, Great Britain, France and Germany, are presented.

Hoyle, M. C.

1979. Response of yellow birch in acid subsoil to micronutrient additions. *Plant and Soil* 51:453-455.

Singular additions of Cu, Zn and Mo had little effect on height or diameter of yellow birch growing in acid subsoil. However, dry weight of leaves was increased by Zn and dry weight of stems was increased by both Mo and Zn. In addition, several macronutrient levels in leaves and roots were increased by micronutrients, and Al in roots was decreased (by 50 percent); Zn was the most effective in causing these favorable changes. Application of Zn is suggested as an alternative or supplement to application of limestone in correcting these problems of yellow birch in acid subsoil.

Hoyle, Merrill C., and A. L. Shigo.

1979. An expanded concept of tree decay. *Phytopathology* 69:1158-1160.

Clarification of the decay processes to include compartmentalization and succession provides new opportunities to regulate tree decay. The more completely the nature of compartmentalization and succession are understood, the better our chances for regulating the processes of tree decay.

Hydorn, S. B., D. T. Jennings, and C. F. Rabeni.

1978. Effect of forest spraying with acephate insecticide on consumption of spikers by brook trout (Salvelinus fontinalis). *Am. Arachnology* 18:12.

Huyler, Neil K., and Lawrence D. Garrett.

1979. A cost analysis: Processing maple syrup products. *USDA For. Serv. Res. Pap. NE-430*. 6 p.

A cost analysis of processing maple sap to syrup for three fuel types, oil, wood, and LP gas indicated that: (1) Fuel, capital, and labor are the major cost components; (2) Wood-fired evaporators showed a slight cost advantage over oil and LP gas evaporators; and (3) There are economies of scale in processing maple sap to syrup. The total production cost for the average size operation using oil, wood, or LP gas was \$8.36, \$7.97, and \$8.37 per gallon of syrup, respectively.

Huyler, Neil K., Lawrence D. Garrett, and Paul E. Sendak.

1979. Economics of sugaring. *New England Farmer*, March. p. 4-5.

The economics of processing maple sap to syrup are important to the producer of maple syrup products. Equipment, labor, and energy costs are rising sharply, reducing profits with every increase, and placing many producers in a cost-price squeeze. Total annual processing costs have risen by about 9 percent per year since 1974, whereas the average farm price has increased by only about 7 percent per year.

Jacobson, Martin, and Daniel T. Jennings.

1978. Attraction of Rhyacionia neomexicana (Dyar) to synthetic pheromones. J. Environ. Sci. Health A13(7):429-443.

The southwestern pine tip moth, Rhyacionia neomexicana (Dyar), is a destructive pest of young ponderosa pine trees. Male moths are attracted to traps containing virgin females, but chromatographic fractions of female abdominal tips failed to entice males. A variety of synthetic materials were field tested at Chevelon, Arizona, over a 6-year period (1971-1976); (Z)-7-Dodecen-1-ol acetate, (E)-9-dodecen-1-ol acetate were attractive to the male moth. However, none of the synthetic compounds was as effective as live virgin females.

Janerette, Carol A.

1978. Solute absorption by seeds of sugar maple. For. Sci. 24: 509-512.

Sugar maple seeds were soaked in 0.5 percent (w/v) aqueous solutions of acidic and basic compounds varying in molecular weight from 100 to 880. In general, only basic compounds penetrated the seeds. The effects of growth regulators on germination was also tested by soaking seeds and fruits in 2 and 10 µg/ml solutions of abscisic acid, gibberellic acid, and indole acetic acid before germinating them. The results suggest that solute absorption by these seeds is not related to molecular weight but rather to the acid-base properties of the solute.

Janerette, Carol A.

1979. Cold soaking reduces the stratification requirement of sugar maple seeds. Tree plant. Notes 30(2):3.

Soaking sugar maple seeds in water at low temperatures for 14 days before they were stratified significantly reduced the time required to surpass 90 percent germination.

Janerette, Carol A.

1979. Seed dormancy in sugar maple. For. Sci. 25:307-311.

Sugar maple seeds were soaked in water or exposed to water vapor under aerobic or anaerobic conditions and subsequently germinated. In general, the anaerobic treatments stimulated germination. The effects of seed covering structures on the diffusion of leachable materials out of sugar maple seeds was also tested. Both immersion in water and exposure to water vapor stimulated germination. This enhancement was attributed to the quasi-anaerobic conditions during inhibition and the leaching of inhibitors.

Janerette, Carol A.

1979. The pathogenicity of fungi isolated from sugar maple seeds. Tree Plant. Notes 30(2):12-14.

The most prevalent fungi isolated from sugar maple seeds were species of Alternaria, Aureobasidium, Epicoccum, Penicillium, and Rhizopus. The seedlings grown in the presence of these fungi exhibited pathogenic symptoms, including chlorotic and necrotic lesions, malformed leaves, and stunted growth.

Janerette, Carol A.

1979. The pathway of water entry into sugar maple seeds.
Seed Sci. & Technol. 7:347-353.

Water absorption by sugar maple (Acer saccharum) seeds was studied in seeds which had been sealed in the region of the micropyle, chalaza, or both. Two portals of water entry to the embryo were demonstrated, one in the chalazal area and another in the micropylar region. However, less water was absorbed through the micropylar region, which contains mucilaginous material lining its inner seed coat.

Jennings, D. T., F. B. Knight, S. C. Hacker, and M. E. McKnight.
1979. Spruce budworms bibliography. Univ. Maine Sch. Nat.
Resour. Misc. Rep. 213. 687 p.

Contains over 1,500 references to literature on coniferophagous budworms. Emphasis is on the spruce budworm, Choristoneura fumiferana (Clem.), and the western spruce budworm, C. occidentalis Freeman, but references to other spruce- and fir-feeding Choristoneura are included. A brief abstract accompanies most references; author and key word indices are included.

Available from National Technical Information Service, Springfield, VA. 22161 (Accession Number PB297124/AS). Price \$19.00.

Jensen, Keith F.

1979. A comparison of height growth and leaf parameters of hybrid poplar cuttings grown in ozone-fumigated atmospheres.
USDA For. Serv. Res. Pap. NE-446. 3 p.

Hybrid poplar cuttings were fumigated with an ozone dosage of 15 ppm-hours. One treatment was a steady fumigation at 0.2 ppm while the second fumigation fluctuated between 0.1 and 0.3 ppm. There were no significant differences in cutting height, leaf area, leaf width, and leaf dry weight, but there were significant differences in chlorophyll and carbohydrate content.

Jensen, Keith F., and Leon S. Dochinger.

1979. Growth responses of woody species to long- and short-term fumigation with sulfur dioxide. USDA For. Serv. Res. Pap. NE-442. 7 p.

Height growth of silver maple, white ash, yellow-poplar, sycamore, eastern cottonwood, and white spruce seedlings was not significantly influenced by 0.15 ppm SO₂ for 8 hours/day, 5 days/week. A fumigation treatment of 0.25 ppm SO₂ for 8 hours/day, 5 days/week did not significantly affect height growth of black alder, yellow-poplar, or white spruce seedlings, but significantly reduced the height growth of eastern cottonwood, green ash, and sycamore seedlings. Exposure to toxic concentrations of SO₂ (1 to 4 ppm) for 2 to 8 hours significantly affected the height growth and caused leaf injury in silver maple and yellow-poplar seedlings. Growth was suppressed only for 14 days after the toxic fumigation because by that time new leaves had formed and normal growth had resumed.

Kaczmarek, Frank S., and Normand R. DuBois.

1979. A simple technique for collecting chyle from the gypsy moth, Lymantria dispar L. USDA For. Serv. Res. Note NE-281. 2 p.

A procedure for rapidly obtaining significant quantities of chyle is described. The amount and composition of chyle collected from larvae of the gypsy moth, Lymantria dispar L., varied according to the instar examined and the age within the instar.

Kennedy, Bruce H.

1979. The effect of multilure on parasites of the European elm bark beetle, Scolytus multistriatus. Entomol. Soc. Am. Bull. 25:116-118.

A study has shown that multilure, the aggregation attractant of Scolytus multistriatus, also attracts several parasites of this beetle: Cheilopachus colon, Entedon leucogramma, Dendrosoter protuberans, Spathius benefactor, and Cerocephala rufa, a possible hyperparasite. Additional studies have also found a component of multilure, α -multistriatin, alone or in combination with α -cubebene or heptanol (the other components), to be an attractant, particularly for C. colon. Heptanol and α -cubebene, alone or in combination, are less effective.

Kennedy, Vance C., chairman. [James W. Hornbeck.]

1978. Research and monitoring of precipitation chemistry in the United States--present status and future needs. U.S. Dep. Inter. Geol. Surv., Off. Water Data Coord., Interagency Advis. Comm. Water Data, Reston, Va. 64 p.

Presents results from a Work Group on Precipitation Quality established by the Federal Interagency Advisory Committee on Water Data. The major conclusion is that the subject of precipitation chemistry continues to be a major gap in our understanding of the hydrologic cycle. Twelve recommendations are given to improve knowledge about precipitation chemistry.

Kingsley, Neal P.

1979. Attitudes of landowners toward timber harvesting in the Northeast. North. Logger 27(4):22.

Kingsley, Neal P., and Douglas S. Powell.

1979. Oak: Where is it? Where's it been? Where's it going? Proc. 7th Annu. Hardwood Symp. Hardwood Res. Counc., Cashiers, N.C. p. 12-28.

Analysis of the oak timber resource in the Eastern United States includes discussion on geographical distribution by volume and species, quality, and growth and removals. Also discussed are the production and export of oaks, as are the attitudes and intentions of forest-land owners as they affect the oak resource.

Kingsley, Neal P.

1979. How important is timber production to small owners?
For. Farmer 38(8):8.

Kochenderfer, J. N.

1979. Some thoughts on forest roads. W. Va. Tree Farm News
3:3.

Discusses the rationale of forest access, touching on some details of logging road construction and costs. Landowners are pinpointed as primarily responsible for the location and condition of logging roads.

Kochenderfer, J. N., and G. W. Wendel.

1978. Cable logging research in the central Appalachians.
Allegheny News, Winter. 1 p.

A truck-mounted crane was used to harvest timber from an experimental watershed near Parsons, West Virginia. The crane yarded efficiently from contour roads spaced 200 to 300 feet apart. Logging costs differed little from those reported by wheeled-skidder operators. Sediment production before, during, and after logging did not exceed amounts reported from undisturbed forest land. About 10 percent of the residual stand was damaged.

Kopcewicz, J., Z. Zatorska, H. Kulikowska, and T. Szczesniak.

1978. Hormonal balance in apical meristems of Scots pine shoots as a very early symptom of flower sex differentiation. Acta Soc. Bot. Pol. 47:107-114. (PL-480 Proj. E21-FS-63 in Torun, Poland, in cooperation with J. A. Romberger).

Many questions can be asked about the relation between growth hormones and flowering in trees. An important one is whether changes in growth hormones induce flowering or whether growth hormone levels are a response to floral induction. This work addressed the question of which comes first. The results of collection and extraction of thousands of presumptive male and female pine buds led to the conclusion that the ratio of auxins to gibberellins is already distinctly different in potentially male and female shoot tips about a month before the embryonic shoots that will bear the strobile are initiated. In that sense, hormonal changes come first.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19), Beltsville, MD. 20705.

Krause, C. R., and K. F. Jensen.

1979. Surface changes on hybrid poplar leaves exposed to ozone and sulfur dioxide. *Scanning Electron Microsc.* 32:77-80, 22.

Hybrid poplar cuttings were fumigated with 0.3 ppm ozone (O_3), 0.5 ppm sulfur dioxide (SO_2), or 0.3 ppm O_3 plus 0.5 ppm SO_2 for 12 hours/day for 21 days. Leaf samples were then prepared for study on a scanning electron microscope. No differences in leaf surface were noted by SEM examination of the samples treated with O_3 or SO_2 on the $O_3 + SO_2$ treated cuttings, leaf symptoms began initially as smooth cuticles and evolved to emaciated epidermal cells.

Krawczynszyn, J., and J. A. Romberger.

1979. Cyclical cell length changes in wood in relation to storied structure and interlocked grain. *Can. J. Bot.* 57:787-794.

Interlocked grain in wood is not confined to species with nonstoried cambia. Such grain is probably even more common in species with storied cambia. Geometry dictates that if current understanding of the development of interlocked grain is correct, then cell length, along with grain-inclination, will fluctuate cyclically. This was tested with samples of the interlocked and storied African "mahogany," Entandrophragma cyclindricum and E. utile, and with samples of the interlocked nonstoried, Nyssa sylvatica and Platanus acerifolia. Analysis of cell length measurements revealed cyclical cell length changes in storied woods, but not in nonstoried. In storied species, average fiber length increases significantly with severity of interlocking. In nonstoried species, no such effect is discernible.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19) Beltsville MD 20705.

Kulikowska, H., J. Kopcewicz, Z. Zatorska, and T. Szczesniak.

1978. Auxins and gibberellins in embryonic shoots of Scots pine in relation to flower sex differentiation. *Acta Soc. Bot. Pol.* 47:403-409. (PL-480 Proj. E21-FS-63 in Torun, Poland, in cooperation with J. A. Romberger).

The various stages of early differentiation of male and female "flowers" of Scotch pine exhibit large differences in the relative amounts of auxins and gibberellins that can be detected in them. Generally, male development is characterized by high gibberellin levels and female development by high auxin and low gibberellin levels. The actual amounts of each, however, vary widely and independently of each other at the various developmental stages.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19), Beltsville, MD 20705.

Laing, F. M., H. Duchacek, S. Williams, N. Huyler, and L. D. Garrett.
1978. Wood residue fuels for maple evaporators. Univ. Vt. Agric.
Exp. Stn. MP101. 32 p.

The use of wood chips is a feasible alternative to fuel oil in maple evaporators. Sources of wood chips were identified and evaluated. A semiautomatic chip feed system was developed, constructed, and demonstrated at the Proctor Maple Research Farm, Vermont Agricultural Experiment Station. Combustion tests gave good results where the moisture content of the chips was less than 35 percent (wet basis).

Lamson, Neil I., and Roger E. McCay.
1979. How to determine whether forest fertilization pays. Proc.
2nd Cent. Hardwoods For. Conf., P.E. Pope, ed. p. 320-327.

Calculations to determine whether fertilization pays can be made in four ways. Rate of return on the investment is the traditional method. Calculating the volume increase needed, the timber value needed, or the fertilization costs needed are other methods the landowner may find easier to understand. Each method is demonstrated for fertilizer applied to sawlog-size red oak trees in north-central West Virginia.

LaPage, W. F.
1979. Market analysis for recreation managers. In Land and leisure: Concepts and methods in outdoor recreation, 2nd ed. Maaroufa Press, Chicago, Ill. p. 259-265.

Describes concepts and procedures used in analyzing markets for a variety of consumer products which can be used effectively in studying trends in outdoor recreation demands.

LaPage, W. F., and G. L. Cole.
1979. The 1978 national camping market survey. USDA For. Serv.
Res. Pap. NE-450. 34 p.

A study of the camping market's short-term growth potential, based upon interviews with the heads of 2,013 representative American households. The study estimates the size of the potential camping market and divides it into three segments: those families with a high, medium, or low potential for entering the camping market. The developed camping market also is divided into an active and an inactive segment, determined by camping participation during the 12 months preceding the survey. The total camping market includes an estimated 17.5 million active camping families, 20.5 million inactive, and 4.5 million potential camping families. Regional distributions and characteristics of each segment are described.

Lautenschlager, R. A., J. D. Podgwaite, and H. Rothenbacher.
1978. Effects of field application of gypsy moth Lymantria dispar L. (Lepidoptera: Lymantriidae) nucleopolyhedrosis virus (Baculovirus) on birds. J. N. Y. Entomol. Soc. 86:303-304.

Resident populations of wild birds and caged quail were evaluated to detect short-term effects from aerial applications of the nucleopolyhedrosis virus (NPV) of the gypsy moth. Comparisons of prespray and postspray censuses as well as histopathological data indicated that the aerial application of NPV had no short-term adverse effect on birds that contacted spray or subsequently fed on NPV-contaminated food sources.

Lautenschlager, R. A. and J. D. Podgwaite.

1979. Passage of nucleopolyhedrosis virus by avian and mammalian predators of the gypsy moth, Lymantria dispar. Environ. Entomol. 8:210-214.

Five species of mammals and three species of birds passed polyhedral inclusion bodies (PIB) of the gypsy moth nucleopolyhedrosis virus (NPV) through their alimentary tracts in amounts great enough to kill gypsy moth larvae in bioassays. All the birds, as well as a shrew and squirrels, passed the PIB within 6 h of intubation, compared with 22 h for raccoons and 70 h for opossums.

Lautenschlager, R. A., H. Rothenbacher, and J. D. Podgwaite.

1979. Response of birds to aerial application of the Nucleopolyhedrosis virus of the gypsy moth, Lymantria dispar. Environ. Entomol. 8:760-764.

Resident populations of wild birds and caged quail, Colinus virginianus L., were evaluated to detect short-term effects from aerial applications of the nucleopolyhedrosis virus (NPV) of the gypsy moth; NPV in two formulations was sprayed on woodland plots in central Pennsylvania. Comparisons of prespray and postspray censuses of the common birds on the control and NPV-treated plots revealed no changes in populations of the wild birds that could be attributed to the NPV treatments. Data on 23 caged quail and 53 wild birds showed no significant differences, or differences in trends, for any species between NPV-treated and control birds in organ weights or necropsy or in histopathological rankings of the condition of organs and tissues.

Leak, William B.

1979. Effects of habitat on stand productivity in the White Mountains of New Hampshire. USDA For. Serv. Res. Pap. NE-452. 8 p.

Mean annual biomass production of sapling stands was higher on washed tills which have a hardwood climax, than on habitats having a softwood climax. However, biomass production of poletimber stands did not differ significantly among habitats. Apparently, differences among habitats in characteristic species composition tend to mask differences in biomass productivity. Mean diameter growth of sugar maple and yellow birch was much better on fine till and enriched habitats than on the other habitats covered by the study. In conducting intensive silviculture operations, it is important to favor species well adapted to habitat.

Leak, W. B.

1979. Tree habitats of the White Mountains. N.H. For. Notes 136: 11-13.

Species composition of forest stands depends on habitat--soil materials and mineralogy. This paper provides an illustrated description of tree habitats in New Hampshire directed toward general readers and practitioners.

Ledig, F. Thomas, and Silas Little.

1979. Pitch pine (Pinus rigida Mill.): Ecology, physiology, and genetics. In Pine barrens: Ecosystem and landscape, Chapter 20. R. T. T. Forman, ed. Academic Press, New York. p. 347-371.

Pitch pine, a hardy species adapted to poor soils with a severe fire history, is the most common Pinus species in the Pine Barrens. Characteristics developed by its adaptations to fire, as well as other characteristics that enable it to thrive on both droughty and wet sites, are discussed.

Leonard, Raymond E., H. E. Echelberger, and M. Schnitzer.

1978. Use characteristics of the Great Gulf Wilderness. USDA For. Serv. Res. Pap. NE-428. 9 p.

Use quantity, use distribution, and overnight use patterns were determined in the Great Gulf wilderness of the White Mountain National Forest in New Hampshire. Data from pressure-plate trail counters and wilderness use permits were validated by observations by patrolmen. Although 60 people are permitted to camp in the Great Gulf each night, a substantial number do not stay overnight.

Leonard, R. E., and H. J. Plumley.

1979. Human waste disposal in eastern backcountry. J. For. 77(5): 349-352.

Effective disposal methods must be chosen in light of both ecological conditions and recreational activities.

Lewis, F. B., and D. O. Etter.

1979. Use of pathogens in forest pest management systems: Gypsy moth (Lymantria dispar L.). In Proceedings of microbial control of insect pests: Future strategies in pest management systems. G. E. Allen, C. M. Ignoffo, and R. P. Jaques, eds. Univ. Fla., Gainesville. p. 261-272.

Discusses the role of pathogens in forest pest management systems, particularly those affecting the gypsy moth. The positive and negative features of microbials are discussed and strategies for microbial use are presented. Preliminary simulation models on NPV epidemiology in natural populations are presented and the potential for disease modeling for use in practical terms is explored.

Lewis, F. B., R. C. Reardon, A. S. Munson, H. B. Hubbard, Jr., N. F. Schneeberger, and W. B. White.

1979. Observations on the use of GYPCHEK. USDA For. Serv. Res. Pap. NE-447. 8 p.

Reports the results of a 1978 aerial test with the gypsy moth NPV product, GYPCHEK. The molasses formulation was more effective when applied with Beecomist[®] nozzles, but Pro-tec[®] formulations were more effective when applied with Flat Fan[®] 8006 nozzles.

Lewis, Franklin B., Michael L. McManus, and Noel F. Schneeberger.

1979. Guidelines for the use of GYPCHECK to control the gypsy moth. USDA For. Serv. Res. Pap. NE-441. 9 p.

Presents positive and negative attributes of GYPCHECK for evaluation by land managers contemplating gypsy moth control. Special precautions and procedures are outlined; environmental and ecological considerations are discussed; and results to be expected from the use of GYPCHECK are given.

Little, Silas.

1978. Management of natural areas. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 5 p.

To permanently preserve natural areas in an unmodified condition for use in scientific research and education, yet open to recreational use, restrictions on general use seem necessary. To manage such areas, it is necessary to lay properly built trails and confine public use to the trails and prohibit collecting plants. Recreational use should be low enough so that its impact is minimal.

Little, Silas.

1978. Reducing construction damage to shade and woodland trees. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 4 p.

Damage to shade and woodland trees can be prevented or greatly reduced by tunneling to avoid root damage when installing underground utility lines; by moving trees back from a cut when making road and grade cuts; by using enough culverts for proper drainage when making fills for roadways; and by preventing heavy construction equipment from injuring roots or boles of trees, or causing soil compaction.

Little, Silas, ed.

1978. Urban foresters notebook.
USDA For. Serv. Gen. Tech. Rep. NE-49. 190 p.

A compilation of articles on many subjects important to the practice of urban forestry in the United States and Canada. General topic areas are: (1) Benefits provided by urban trees and stands; (2) Culture and protection of the urban forest; (3) Management of the urban forest system; and (4) Interface with land-use planning. The notebook is loose-leaf in form so that supporting technical reports can be added to each topic area.

Little, S.

1979. The pine barrens of New Jersey. In Heathlands and related shrublands of the world. A. Descriptive studies. R.L. Specht, ed. Elsevier, Amsterdam. p. 451-464.

Little, Silas.

1979. Ecology and silviculture of Pine Barrens forests. In Natural and cultural resources of the New Jersey Pine Barrens. John W. Sinton, ed. Stockton State Coll., Rutgers Univ., and N. J. Dep. Environ. Prot. p. 105-118.

The composition of the forests of the Pine Barrens has been shaped by differences in soil, succession, animal effects, and past history of repeated cutting and repeated fires. The differences in the composition affect the suitability of habitats for wildlife. Knowledge of the factors that shaped these forests suggests measures that could be used to alter their compositions.

Little, Silas.

1979. Fire and plant succession in the New Jersey Pine Barrens. In Pine barrens: Ecosystem and landscape, Chapter 17. R. T. Forman, ed. Academic Press, New York. p. 297-314.

Analyzes the natural patterns of succession and discusses how fires modify these patterns to produce variations in the Pine Barrens landscape. Also discusses the effects of cutting, land clearing and abandonment, deer browsing, beaver-caused flooding, and human activities.

Little, Silas.

1979. Sweetfern blister rust cankers on loblolly pines in a southern New Jersey plantation. Bull. N. J. Acad. Sci. 24(2):70-72.

In southern New Jersey, sweetfern blister rust (Cronartium comptoniae) caused stem cankers on 38 percent of the loblolly pines established by planting or seeding in one area, none on similarly established pitch and shortleaf pines. Rodents, possibly chipmunks, gnawed cankers on 15.7 percent of the loblolly pines only in the fall of 1974, hastening the death of some cankered trees.

Little, Silas, and John J. Mohr.

1979. Reestablishing understory plants in overused wooded areas of Maryland state parks. USDA For. Serv. Res. Pap. NE-431. 9 p.

In four overused areas, the treatments of small plots were fencing, scarifying the soil, and mulching; fencing and mulching plus planting of shrubs, herbaceous plants, or greenbrier with shrubs or holly. After 3 years, soil compaction was two to four times as great in check plots as in treated plots. Understory cover varied with conditions, but because of volunteer growth, planting was not nearly so important as mulching and eliminating use in reestablishing an understory.

Little, Silas, and I. Frederick Trew.

1979. Pitch X loblolly pine hybrids: Loblollies for the North? J. For. 77:709-713, 716.

From controlled pollinations in a New Lisbon, New Jersey, orchard of selected pitch (Pinus rigida) and loblolly (P. taeda) pines, 29 test plantings have been made in nine states. Results indicate that well-formed,

rapid-growing, winter-hardy trees can be produced by careful selection of parents and screening of hybrids. Steps are being taken to provide material for mass plantings.

Little, Silas, and I. Frederick Trew.

1979. Possibilities of pitch X loblolly pine hybrids in the interior South. In Proceedings of symposium on the management of pines of the interior South. USDA Forest Serv., Southeast. Area State Priv. For. Tech. Publ. SA-TP-2. p. 151-158.

Test plantings made since 1971 in western Kentucky, West Virginia, western Virginia, Maryland, and southern New Jersey suggest that pitch X loblolly pine hybrids offer great promise for providing fast-growing winter-hardy pines for the interior South. With enough work in selection, breeding, and testing, hybrids can be produced that apparently will rival loblolly pine's rate of growth. They even have such growth on relatively poor sites and in areas where loblolly pine suffers both winter drying and dieback. Much more work needs to be done to obtain such hybrids and then to provide material for mass plantings.

Lynch, Carol B., and Marjorie A. Hoy.

1978. Diapause in the gypsy moth: Environment-specific mode of inheritance. Genet. Res. Camb. 32:129-133.

McCauley, Orris D.

1978. Requirement for an economic evaluation of thinning and timber stand improvement. In Economic forum on forest land ownership, management and investment. Proc. Soc. Am. For. Wis.-Mich. Sect. Meet. [March 9-10, Marquette, Mich.] p. 109-120.

An economic evaluation of thinning and timber stand improvement of precommercial hardwood stands requires the blending of results from applied silviculture practices, tree quality measurements, and investment economics research. By using a sample problem outline, the requirements for a thinning evaluation can be identified. The requirements for a typical thinning problem solution are classified into four need classes: (1) Stand inventory; (2) Stand projection; (3) Economic inventory; and (4) Comparative analysis. A review of the needs for stand inventory and stand projection shows that research results for evaluating silvicultural practices and quality development are inadequate. A research program at the Northeastern Forest Experiment Station is directed toward supplying research results to meet these needs.

McCay, Roger E., David A. Gansner, and John J. Padalino.

1978. Measuring the attitudes and awareness of environmental education camp users. USDA For. Serv. Res. Pap. NE-426. 13 p.

Questionnaires for evaluating what people expect from environmental camps and what they learn while there have been developed and applied at the Pocono Environmental Education Center, Dingman's Ferry, Pennsylvania. Nine questionnaires for various ages and types of users are presented. The results can be used by camp administrators and educators to evaluate their own programs and teaching methods.

McCay, Roger E., David A. Gansner, and Jane R. Riddle.

1978. Preparing directories to local outdoor recreation facilities.
USDA For. Serv. Gen. Tech. Rep. NE-46. 20 p.

A good guide to local outdoor recreation facilities can be developed in five basic steps. Knowing your users and what information they need are key ingredients to success. The procedure outlined here was used successfully in northeastern Pennsylvania in 1976.

MacDonald, William L., Franklin C. Cech, John Luchok, and Clay Smith, eds.

1979. Proceedings of American chestnut symposium. W. Va. Univ.
Coll. Agric. and For., Morgantown. January 1978. 122 p.

Includes discussion of historical accounts of chestnut blight and discussions of the status of selecting, breeding, and use of other techniques to produce blight resistant trees. Researchers from France, Italy, and the United States discuss the potential for biological control of chestnut blight.

McManus, Michael L.

1979. Impacts of airborne insects. Chapter 6, Impact of airborne materials on living systems. Aerobiology: The ecological systems approach. R. L. Edmonds, ed. US/IBP Synth. Ser. 10. Dowden, Hutchinson and Ross, Stroudsburg, Pa. p. 183-192.

Dispersal of airborne arthropods results in direct damage to cultivated crops and forest trees and long-range transmission of disease-causing organisms. Two categories of impact caused by dispersal are reviewed in detail: extension of range and long-range dispersal or migration.

McManus, Michael L.

1979. Insects and other microfauna. Chapter 2, Sources and characteristics of airborne material. Aerobiology: The ecological systems approach. R. L. Edmonds, ed. US/IBP Synth. Ser. 10. Dowden, Hutchinson and Ross, Stroudsburg, Pa. p. 54-70.

Insects and other arthropods are the largest particulates that are actively or passively dispersed through the atmosphere. The biological significance among arthropods is discussed, including the factors that determine their relative abundance, mode of release, and survival. Examples emphasize the importance of behavior in the dispersal of these organisms.

McManus, Michael.

1979. Dispersal of forest insects. In Radar, insect population ecology and pest management. C. Vaughn, W. Wolf, and W. Klassen, eds. NASA Conf. Publ. 2070. p. 35-39.

The importance of dispersal in the population dynamics of many forest insects is discussed, with emphasis placed on the Lepidoptera. Details are provided on the dispersal of the gypsy moth, spruce budworm, and forest tent caterpillar.

McManus, Michael L., and Roger T. Zerillo.

1979. The gypsy moth: An illustrated biography. U.S. Dep. Agric. Home Gard. Bull. 25. 15 p.

A booklet written for the layman that discusses the life history, life stages, and behavior of the gypsy moth. Color photographs help identify each life stage and illustrate some of the insect's characteristic habits.

Marquis, David A.

1978. The effect of environmental factors on the natural regeneration of cherry-ash-maple forests in the Allegheny Plateau region of the eastern United States. In Proceedings of symposium Fevillus Precieus, Nancy, France. p. 90-99.

Regeneration failures caused by inadequate advance regeneration, low seed production, excessive deer browsing, and allelopathic interference by understory plants are common in Allegheny hardwood stands. Factors such as sunlight, soil moisture, and soil temperature were studied for various species. Although species varied widely in environmental requirements for germination and growth, a shelterwood sequence appears to best meet these requirements for a majority of Allegheny hardwoods.

Marquis, David A.

1978. Tree regeneration and deer. Pa. For. Resour. 61, 4 p.

Browsing by deer is a major cause of regeneration failures in hardwood stands in northwestern Pennsylvania. The long-term solution is a better balance of deer to available habitat. Until this balance is achieved, other methods must be employed to ensure successful regeneration. Planting seedlings has been unsuccessful, as deer show a preference for the more nutritious nursery-raised seedlings. Likewise, chemical repellents have been ineffective. Area fencing and individual seedlings protection, while effective, are costly. More promising and cheaper is the use of nitrogen fertilizer to grow seedlings rapidly out of reach of the deer. Also promising are silvicultural techniques, especially a properly timed shelterwood sequence.

Marquis, David A.

1979. Shelterwood cutting in Allegheny hardwoods. J. For. 77: 140-144.

In a study of four levels of cutting (removal of none, one-third, two-thirds, or all of a fully stocked 55-year-old stand), removal of one-third of the basal area provided best conditions for the establishment of new seedlings of preferred species, especially black cherry. Height growth was limited, an indication that the remaining overstory should be removed in 5 to 10 years. Fern and grass cover increased after all levels of cutting on poorly drained soils, creating potential interference with the seedlings. These plants were not a problem on well-drained soils.

Marquis, David A., and Ted J. Grisez.

1978. The effect of deer exclosures on the recovery of vegetation in failed clearcuts on the Allegheny Plateau. USDA For. Serv. Res. Note NE-270. 5 p.

In 6- to 10-year-old clearcuts that had failed to regenerate naturally, fencing was erected to protect seedlings from deer browsing. The fencing allowed the gradual recovery of the forest cover. Small seedlings that otherwise would have been browsed continued to grow, and ground cover species such as Rubus, which reduced ferns and grasses that sometimes interfere with seedling development, were reestablished. Fencing alone is likely to promote satisfactory restoration of forest cover only in failed clearcuts that contain adequate numbers of seedlings initially--few new seedlings became established after fencing.

Martin, C. Wayne.

1979. Precipitation and streamwater chemistry in an undisturbed forested watershed in New Hampshire. *Ecology* 60:36-42.

Precipitation and streamwater from the Bowl, a watershed in central New Hampshire, were analyzed chemically during 1973 and 1974. The Bowl, covered by a northern hardwood forest, has never been logged or otherwise disturbed by humans. Nitrate budgets indicated a net loss of this important plant nutrient from the watersheds. A new accumulation of ammonium-nitrogen was sufficient to give a net increase of nitrogen to the watersheds. Forests free from human disturbances may reach an age where they become prone to natural disturbances that create a mosaic of similar-aged groups of trees, each group having different abilities to accumulate nutrients.

Martin, C. Wayne, and Robert S. Pierce.

1979. Clearcutting configurations affect the magnitude and duration of nutrient losses in northern hardwood forests. In Impact of intensive harvesting on forest nutrient cycling proceedings. SUNY Coll. Environ. Sci. and For., Syracuse. p. 406.

More, Thomas A.

1978. Graduate recreation education in U.S. Forestry schools: A status report and comment. *Proc. Soc. Am. For. Annu. Meet.*, St. Louis, Mo. p. 416-418.

Despite the increasing importance of recreation as a forest management problem and the rapid growth of technical information about the subject, little is known about the demand for or supply of people with graduate training in forest recreation. A survey of forest supervisors from the Forest Service found that most felt recreation management problems would be increasing and expressed the desire to have people with graduate training in forest recreation to handle them. Currently, 28 of 43 SAF accredited forestry schools offer such training. Most are located in the East and tend to have about seven master's students and one to two doctoral students. The implications of these findings for forestry education are discussed.

More, Thomas A.

1979. The demand for nonconsumptive wildlife uses: A review of the literature. *USDA For. Serv. Gen. Tech. Rep. NE-52*. 16 p.

Nonconsumptive use is a generic term for a variety of recreational activities related to wildlife, including general wildlife observation, birdwatching, birdfeeding, wildlife and bird photography, and other related activities. This report reviews the literature about the demand for nonconsumptive wildlife use.

More, Thomas A.

1979. Wildlife preferences and children's books. Wildl. Soc. Bull. 7(4):272-278.

Many of today's children first come in contact with wildlife through the medium of children's books. Because these books are sold through the marketplace, the number of books about a specific animal may be a general indicator of that animal's popularity; that is, the more popular an animal, the greater the number of books written about it. A comprehensive index of titles was used to categorize children's stories about animals. More than 60 percent of the animals mentioned in the titles were mammals; birds accounted for an additional 18 percent. Publishers target books about mammals at the youngest age groups. These findings raise several interesting points about wildlife preferences and anthropomorphism.

More, Thomas A., and Gregory J. Buhyoff.

1979. Managing recreation areas for quality user experiences: A theoretical framework. USDA For. Serv. Res. Pap. NE-432. 14 p.

The production of opportunities for high-quality visitor experiences is a basic goal of recreation management. Recreation quality can be interpreted by using concepts from psychological field theory to relate emotion to the strength of motivation. Applications to on-site management for recreation quality and use regulation are suggested.

Moser, John W., Jr., Carl H. Tubbs, and Rodney D. Jacobs.

1979. Evaluation of a growth projection system for uneven-aged northern hardwoods. J. For. 77:421-423.

A model for the simulation of growth on mature, uneven-aged northern hardwood stands composed principally of sugar maple (Acer saccharum) was evaluated with independent data. The model provides estimates of basal area, volume, and number of trees by size class for ingrowth, survivor growth, and mortality. The test data were obtained from cutting-cycle and residual-density studies. Comparisons indicate that basal area and volume are more accurately predicted than is number of trees. Generally, however, the results demonstrate the utility of the model in forest management.

Mulhern, J., W. Shortle, and A. Shigo.

1979. Barrier zones in red maple: An optical and scanning microscope examination. For. Sci. 25:311-316.

Barrier zones in 10 wounded red maple trees were studied with optical microscopy with reflected and transmitted light, scanning electron microscopy, and dye penetration. Vessels in the barrier zone were abnormal and fewer in number, and vessel segments were irregular in shape. Vertical transport of fluid in this region was markedly reduced, and opacity to transmitted light was increased, compared with normal secondary xylem.

Nayar, R., and C. E. Seliskar.

1978. Mycoplasma like organisms associated with yellow leaf disease of Areca catechu L. Eur. J. For. Pathol. 8:125-128.

Mycoplasma-like organisms (MLO) were found in the young sieve elements of arecanut palms declining with yellow leaf disease in Kerala and Karnataka States of India. The organisms resembled those MLO found in coconut palms affected with lethal yellowing in Florida and Africa.

Neisses, J. A., and H. B. Hubbard.

1978. Application of microbial insecticides on forests. Entomol. Soc. Am. Misc. Publ. 10:27-43.

Nenno, Edward S., and William M. Healy.

1979. Effects of radio packages on behavior of wild turkey hens. J. Wildl. Manage. 43(3):760-765.

The effects of radio packages on the behavior of wild turkeys are either unknown or poorly understood. Among 11 wild turkeys that had been imprinted to humans, short-term disruptions of behavior occurred during 1 to 2 days after instrumentation. Subtle adjustments to the radio package occurred during the first week. There were no permanent changes in the behavior of birds with transmitters; therefore, it is concluded that the radio package does not introduce any serious bias into the study of wild turkey ecology.

Nevel, Robert L., Jr., and David R. Dickson

1979. Northeastern pulpwood 1977--An annual assessment of regional timber output. USDA For. Serv. Resour. Bull. NE-60. 27 p.

This annual assessment of regional timber output is based on a canvass of the pulp mills in the Northeast. The report contains a discussion and tabular data on roundwood and chips from plant residues produced in and received by 14 Northeastern States in 1977: pulpwood production by state, county, and species group; pulpwood receipts from roundwood by state and species group; pulpwood chip receipts by state and species group; and production of total-tree chips. From 1976 to 1977, pulpwood production increased by 10 percent; roundwood production rose by 4 percent; and chipped residue production jumped by 29 percent. Current record levels and trends in pulpwood production for the past 15 years are discussed. A list of the woodpulp mills that received northeastern pulpwood during 1977 is included.

Nicholson, E., and M. E. Demeritt, Jr.

1978. Cleaning Populus seed with a blender. Silvae Genet. 27(5):216.

Noble, R. D., and K. F. Jensen.

1979. Effects of SO₂ and SO₂ + O₃ on photosynthesis. Plant Physiol. 63(5):150.

Northeastern Forest Experiment Station.

1979. 1977-1978 Report. USDA For. Serv. Gen. Tech. Rep.
NE-50. 206 p.

A summary report on highlights of research activities and accomplishments of the Northeastern Forest Experiment Station in 1977 and 1978, including an annotated list of publications.

Northeastern Forest Experiment Station.

1979. How to prepare manuscripts for Station publication: A desk guide for authors and typists. 2nd ed. USDA For. Serv. Northeast. For. Exp. Stn. Broomall, Pa. (Unnumbered publ.).

Northeastern Forest Experiment Station.

1979. Mulches help turn bleak to beautiful. U.S. Dep. Agric. For. Serv., Northeast. For. Exp. Stn. Photo Story 37.

Nyland, Ralph D., and David A. Marquis.

1979. Appropriate silviculture systems for northern hardwoods. In Proceedings of 1978 joint convention of the Society of American Foresters and the Canadian Institute of Forestry. p. 334-338.

Appropriate silvicultural systems for managing northern hardwoods should accommodate interests of the landowner and capabilities of the site and stand. For even-age systems, intermediate treatments followed by an appropriate regeneration method will establish a new crop at the end of the rotation. The use of heavy thinnings toward the end of the rotation will establish needed advance seedlings. For uneven-aged stands, regeneration, tending, and harvest are combined into one operation repeated periodically at frequent intervals.

Odell, Thomas M., and Paul A. Godwin.

1979. Attack behavior of Parasetigena silvestris in relation to host density and behavior. Ann. Entomol. Soc. Am. 72:281-286.

The synchrony and interaction of the tachinid parasite, Parasetigena silvestris (Robineau-Desvoidy), with the gypsy moth, Lymantria dispar (L.), were studied in Connecticut in 1973 and 1974. The number of P. silvestris adults caught on colored sticky tubes and the number of P. silvestris eggs laid per larva each year were related to the number of large gypsy moth larvae available, but there was a threefold difference between the 2 years in the ratio of eggs laid to larvae available. Both the number of larvae attacked (with at least one egg) and the incidence of superattacks (more than one egg) were inversely proportional to the number of large larvae.

ODell, Thomas M., and Paul A. Godwin.

1979. Laboratory techniques for rearing Blepharipa pratensis, a Tachinid parasite of gypsy moth. Ann. Entomol. Soc. Am. 72:632-635.

Laboratory-reared 5th-and 6th-stage gypsy moth larvae were fed Blepharipa pratensis (Meigen) eggs placed on gypsy moth diet to induce parasitization. Laboratory-reared B. pratensis laid an average of 900 eggs per female. Using survival estimates for each life stage, the ratio of increase in egg laying females for a generation reared in the laboratory was 1:34. Some eggs retained viability when stored at 0°-2°C and 40 percent RH for up to 4 weeks. Pupae stored at 0°-2°C and 100 percent RH were held successfully for 3 months beyond the normal adult eclosion period. By proper timing of adult eclosion and egg feeding, the period for biological study of the parasite was extended for 3 to 4 months.

Parker, Johnson.

1978. Effects of heat, cold, drought, wind, and salt spray on urban trees. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 8 p.

Discussion of tree-damaging effects of heat (temperatures of about 100°-150°F), cold (temperatures generally below -32°F), wind (storms, etc.), and salt spray (wind-driven ocean spray).

Parker, Johnson.

1978. Effects of unfavorable soil conditions on urban trees. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 8 p.

Discusses the usual soil conditions that cause problems to the health and growth of trees, especially in cities, including gases, salt, poor aeration, etc.

Parker, Johnson.

1978. Fertilization of trees. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Considers methods for adding commercial fertilizers to city trees to improve their growth and health.

Parker, Johnson.

1979. Effects of defoliation and root height above a water table on some red oak root metabolites. J. Am. Soc. Hort. Sci. 104:417-421.

Seedlings of northern red oak, Quercus rubra L., were subjected to moisture stress and defoliation. Root growth and starch content declined as moisture stress and defoliation severity increased. Fructose and glucose, as well as several amino acids, were sharply higher with increasing moisture stress and these sugars were higher in defoliated than in undefoliated seedlings. Sucrose decreased with increasing severity of defoliation and tended to decrease with increasing moisture stress among defoliated seedlings.

Parker, Johnson.

1979. Seasonal variations in photosynthesis in black oak twigs. *Photosynthetica* 12:423-427.

Photosynthetic rate (P) of leafless twigs was measured monthly over a 2-year period as a decline in CO_2 released after illumination at 65 Klx. P measured 1 h after twigs had been brought to 25°C was nil in February and March, but recovered to measurable amounts by April in both years of study. P was measurable 24 h after the twigs had been warmed to 25°C at various times throughout the winter. Respiration (R_D) also measured 1 h after the twigs had been brought to 25°C, declined in winter in both years to about a third of the summer rate. P in summer in three separate locations over 2 years never reached the compensation point. Bark water content changed seasonally and may be related to certain changes in P , but not to the winter depression of P .

Patric, James H.

1979. Can forest land produce wood, recreation, and high quality water, too? *North. Logger* 27(12):6-7, 36-37.

Land use since 1900 is reviewed briefly as it relates to the watershed of Elk Lick Run, a 1,400-acre portion of the Fernow Experimental Forest supplying water to Parsons, West Virginia. Scientists, loggers, and recreationists use the area heavily, perhaps as heavily as any municipal watershed in the Eastern United States. The effects on chemical and physical properties of water are minimal. Restricted use of the watershed would have cost the public far more, in terms of foregone wood and jobs, than the public would have gained in benefits to water resources.

Patric, Jim.

1979. What happens to rain before and after a forest is cut? *W.Va. Tree Farm News* 3:4.

The hydrologic cycle is briefly compared as it functions in the cut and uncut hardwood forest. Soil erosion is discussed, particularly soil loss from logging roads. Most erosion is from logging roads and can be controlled.

Patric, James H., and Stanley Caruso.

1979. Solar radiation at Parsons, West Virginia. *USDA For. Serv. Res. Note NE-272*. 6 p. illus.

Twelve years of solar radiation data, measured with a Kipp-Zonen pyranometer, were recorded near Parsons, West Virginia. The data agree well with calculated values of potential and average radiation for the vicinity and are applicable to the central Appalachian region.

Patric, J. H., and D. W. Smith.

1978. Some effects of urea fertilization on a forested watershed in West Virginia. *Proc. 2nd Cent. Hardwoods For. Conf., P.E. Pope, ed.* p. 210-227.

A 75-acre watershed on the Fernow Experimental Forest near Parsons, West Virginia, was fertilized in May 1971, with 500 pounds of urea per acre. Nitrogen content of soils on south slopes decreased in 1972, and was unchanged at other times and places. Nitrogen content of yellow-poplar buds increased only in 1972. Streamflow decreased 1.23 inches in the same year but its pH was unchanged. About 20 percent of the nitrogen applied as urea has been lost in streamflow accompanied by stoichiometrically balanced outflows of major cations, such as calcium, magnesium, and sodium.

Payne, Brian R.

1978. Evaluation of tree losses. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Methods to determine tree losses on residential properties are: (1) Replacement cost; (2) Contributions to property value; (3) Formula or point systems; (4) Annual crop production; (5) Conversion to wood products, and (6) Cost basis. Replacement cost is easy, objective, and best suited to small trees. Contributions to property value are calculated as the value of the entire property within the trees, minus the property without the trees. This method is accepted by the Internal Revenue Service to determine casualty loss deductions. Formula or point systems allow a dollar value per square inch of trunk cross section dbh. The method requires experience and judgment. Crop production relates to fruit trees; conversion to wood products is used for trees grown for that purpose; and cost basis evaluation is based on the cost of getting a tree in place and maintaining it.

Payne, Brian R.

1978. Trees increase residential property values. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 5 p.

Trees can contribute substantially to the monetary value of residential property. Houses on well-treed lots may sell for between 6 and 12 percent more than identical houses without trees. Trees may add several thousand dollars to the value of a house lot, but trees should be greater than 6 inches dbh and not too numerous--generally less than 30 per half-acre lot, lest the property appear too shaded or crowded.

Payne, Brian R., and Joanne E. Gallaher.

1979. National urban forestry conference. J. For. 77:284-286.

Peacock, John W.

1979. Behavior-modifying chemicals for elm bark beetles. Entomol. Soc. Am. Bull. 25:101.

Peters, Penn A.

1978. Spacing of roads and landings to minimize timber harvest cost. For. Sci. 24:209-217.

Presents a direct method to determine optimum road spacing and optimum landing spacing that will minimize timber harvest cost. A necessary condition for minimum cost is that variable yarding costs equal road costs plus twice the landing costs.

Plass, William T.

1979. The use of southern pines for surface mine reclamation. In Proceedings of symposium on the management of pines of the interior South. USDA For. Serv., Southeast. Area State Priv. For. Tech. Publ. SA-TP-2. p. 176-182.

Pines of the interior South are native to much of the Appalachian and Interior coal provinces and have been used widely for mined-land reclamation. Species recommendations are often site specific and recognize location, site characteristics, properties of mine soil, compatibility with other vegetation, and land-use objectives. The basic technology does not differ significantly from that used routinely on natural soils. Special techniques may be required for evaluating the site, determining appropriate amendments, and selecting compatible herbaceous ground covers. Other systems may be used to improve survival and growth. The challenge to land managers is to recognize the productive capacity of mine soils and to use existing reclamation technology to maximize this potential.

Podgwaite, J. D.

1979. Diseases of the gypsy moth: How they help to regulate populations. U.S. Dep. Agric., Agric. Handb. 539. 14 p.

In the Northeastern United States, the gypsy moth is subject to a variety of naturally occurring infectious and noninfectious diseases. Infectious diseases are caused by several kinds of bacteria and fungi, and by a virus specific to the gypsy moth. Noninfectious diseases result from adverse physiological changes in the insect, generally in response to weather conditions, food quality, or hereditary factors.

Podgwaite, J. D., Kathleen Stone Shields, R. T. Zerillo, and R. B. Bruen.

1979. Environmental persistence of the nucleopolyhedrosis virus of the gypsy moth, Lymantria dispar. Environ. Entomol. 8:528-536.

Concentrations of infectious gypsy moth nucleopolyhedrosis virus (NPV) that occur naturally in leaf, bark, litter, and soil samples taken from woodland plots in Connecticut and Pennsylvania were estimated and compared with those in samples taken from these plots after treatment with NPV. Results indicated that NPV is a natural component of the host's habitat, persisting for at least 1 year after natural epizootics. The application of NPV at the rate of 2.5×10^{12} polyhedral inclusion bodies (PIB)/ha to an area containing high concentrations of naturally occurring NPV did not cause an increase in the environmental NPV load, although application at the rate of 5×10^{12} PIB/ha to plots containing low natural concentrations resulted in measurable increases. However these increases were not significantly higher than those occurring in a control plot.

Pogge, Franz L.

1979. Review of "Plant performance on surface coal mine spoil in Eastern United States." *Castanea* 44(2):126-127.

A practical guide, written by Joseph D. Ruffner, to the performance of particular trees, shrubs, vines, brambles, grasses, legumes, and forbs when used to revegetate very acid, acid, or slightly acid mine spoils. Fertilizer requirements are also discussed.

Powell, Douglas S., and E. H. Tryon.

1979. Sprouting ability of advance growth in undisturbed hardwood stands. *Can. J. For. Res.* 9:116-120.

Eight species of hardwoods were studied to evaluate their ability to produce seedling sprouts in the advance growth of undisturbed, mature stands on high-quality upland sites in West Virginia. The most reliable criterion used to measure this ability was the percentage of seedling sprouts, which indicated relatively good ability for white oak and black cherry; intermediate ability for dogwood, hickory, and white ash; and relatively poor ability for red maple, northern red oak, and sugar maple. The two oaks were at opposite ends of the spectrum, which suggests that factors other than the ability to produce seedling sprouts may explain the growth of virtually pure oak stands on high-quality sites.

Raimo, B., R. C. Reardon, and J. D. Podgwaite.

1977. Vectoring gypsy moth nuclear polyhedrosis virus by Apanteles melanoscelus (Hym: Braconidae). *Entomophaga* 22:207-215.

Gypsy moth larvae were exposed to Apanteles melanoscelus females contaminated with nucleopolyhedrosis (NPV). Three methods of contamination (ovipositor, total body surface, and exposure to infected hosts) and two exposure periods were tested. There was a significantly greater incidence of larval mortality caused by virus among larvae exposed to contaminated parasites. There were no significant differences in larval mortality caused by virus among the three methods of contamination or in parasite emergence from larvae parasitized by contaminated or uncontaminated parasites.

Rast, Everette D.

1978. Volume relationships in slicing northern red oak and black cherry logs. *USDA For. Serv. Res. Pap. NE-420*. 11 p.

Veneer-quality logs of black cherry and northern red oak from northern Pennsylvania were converted into sliced face veneer. The percentage yield of veneer for cherry was greater than that for oak because of tree form. Thirty-four percent of the total log volume for oak became chippable or fuel residue, but only 29 percent of cherry. Where and why this loss of material occurs in the veneering process is discussed.

Rexrode, Charles O.

1978. Movement of oak wilt fungus in a tracer solution under pressure through root grafts. Plant Dis. Rep. 62(11):982-984.

In northeastern West Virginia, 26 oaks were pressure-injected with Azosulfamide plus a suspension of conidia of the oak wilt fungus. Translocation of the tracer solution and oak wilt fungus to adjacent oaks showed that at least 35 percent of the injected trees were connected by root grafts to adjacent trees. Fifty percent of the transmission via root grafts were evident 1 year after treatment, an additional 10 percent after 2 years, and the remaining 40 percent, 3 years after injection.

Rexrode, Charles O.

1979. Effects of disbudding on shoot mortality and stem deformity in black cherry. USDA For. Serv. Res. Note NE-280. 4 p.

Insect damage was simulated by the removal of buds from black cherry trees to determine the effects on stem mortality and tree form. Black cherry was very sensitive to disbudding. All degrees of disbudding caused terminal deformities and stem deformity nearly always occurred after the terminal bud was destroyed. Shoot mortality usually occurred after half or more of the buds on the terminal branch were removed. The types of deformities are illustrated.

Reynolds, Hugh W., and Charles J. Gatchell.

1979. Marketing low-grade hardwoods. Furniture Design & Manuf. 51(10):88, 90, 92.

A hardwood shortage of high-grade lumber exists while there is a surplus of low-grade hardwood timber. Needed for the surplus to correct the shortage are a new manufacturing system and a new marketing technique. Researchers at the Forestry Sciences Laboratory at Princeton, West Virginia, have developed a system for converting low-grade hardwood for furniture use. The manufacturing steps can be integrated with the existing marketing system from the timber grower to the logger to the sawmiller to the dimension maker to the furniture producer.

Reynolds, Hugh W., and Charles J. Gatchell.

1979. Marketing low-grade hardwoods for furniture stock--a new approach. USDA For. Serv. Res. Pap. NE-444. 7 p.

Describes a new system for converting low-grade hardwood into furniture. The manufacturing steps can be integrated with the existing marketing system from the timber grower to the logger to the sawmiller to the dimension maker to the furniture producer.

Rothwell, Frederick M., and James M. Trappe.

1979. Acaulospora bireticulata sp. Nov. Mycotaxon 8:471-475.

Acaulospora bireticulata, a new species of the vesicular-arbuscular mycorrhizal fungi, has been isolated from a perimeter soil sample of the Kentucky Dam tree nursery site. Endomycorrhizal status was verified through root analysis of natural and greenhouse plant specimens. Type material has been deposited in the herbarium at Oregon State University.

Rupe, Mary Lynn, R. E. Leonard, and J. J. Lindsay.

1979. Hikers' views of backcountry management. Univ. Vt. Res. Rep. SNR-RM6.

A written survey was administered to hikers in an undeveloped state park in Vermont during 1977. The attitudes of these hikers toward current and alternative management policies are discussed.

Safford, L. O.

1979. A technique for evaluating growth and foliar nutrient response to fertilizer treatments. Proc. 5th N. Am. For. Biol. Workshop. Univ. Fla., Gainesville. p. 421.

Sarles, Raymond L.

1979. Wood fuel plentiful in West Virginia. USDA For. Serv. Res. Note NE-279. 4 p.

Biomass estimators applied to West Virginia timber resource data indicate that 34 million tons of wood is potentially available for fuel each year. This tonnage is the annual forest growth in excess of that now harvested for roundwood products. One-half of this excess can supply more than all of the State's energy needs in the residential and commercial sectors, or 44 percent in the industrial sector.

Sawyer, Alan G., Parker M. Worthing, and Paul E. Sendak.

1979. The role of laboratory experiments in test marketing strategies. J. Mark. 43(3):60-67.

An experiment described in this article is used to illustrate how laboratory experimentation can be an efficient and managerially useful source. Procedures to assess the validity of a laboratory experiment and considerations of the role of laboratory experimentation in a research system that employs both lab and field environments are discussed.

Schmitt, Dan, Peter W. Garrett, and Alex L. Shigo.

1978. Decay resistant hardwoods? You bet! North. Logger 27(3): 20-21, 30-31.

The authors suggest that there is a generalized decay resistance response to wounding in hardwood trees, and that it is under genetic control. Research results from several species are cited to support this hypothesis. The authors evaluate the contribution hardwood decay resistance would make to landowners, loggers, and mills, if it were incorporated in on-going hardwood tree improvement programs.

Schmitt, Mark D. C., Mirosław M. Czapowskyj, Lawrence O. Safford, and Albert L. Leaf.

1979. Biomass and elemental content of fertilized and unfertilized Betula papyrifera Marsh. and Populus grandidentata Michx. In Impact of intensive harvesting on forest nutrient cycling proceedings. SUNY Coll. Environ. Sci. and For., Syracuse. p. 416.

Schuler, Albert T.

1978. An econometric analysis of the U.S. hardboard market. USDA For. Serv. Res. Pap. NE-424. 7 p.

An econometric model of hardboard consumption in the United States was developed to identify the major variables affecting hardboard consumption and price. The variables identified were housing starts, residential improvement activity, disposable personal income, hardwood plywood price, productivity, pulpwood and residue price, hardboard tariff, and power cost. Disposable personal income was the most important of these variables affecting both consumption and price. Annual projections show consumption increasing by 60 percent and price by 133 percent (over 1977 levels) by the year 1990.

Schuler, Albert T.

1979. Econometric model of the domestic insulation board industry. For. Prod. J. 29(8):21-25.

An econometric model of the domestic insulation board industry was developed to identify and quantify the major factors affecting quantity consumed and price. The factors identified were housing starts, residential improvements, disposable personal income, productivity in the insulation board industry, pulpwood and plant residue prices, and power costs. Disposable personal income was the most important factor affecting both price and consumption. Projections of consumption and price showed increases of 30 and 106 percent, respectively, by the year 1990.

Schuler, Albert T., and Walter B. Wallin.

1979. An econometric model of the U.S. pallet market. USDA For. Serv. Res. Pap. NE-449. 11 p.

A need for quantitative information on demand and price has been expressed by the pallet industry. In response to this, an econometric model of the aggregate pallet market in the United States was developed. Demand was found to be affected by real pallet price, industrial and food production levels, and slipsheet prices. Supply was affected by real price, housing starts lagged 1 year, and productivity within the pallet industry. Industrial production activity had the strongest impact on pallet demand, while real price was the most influential supply variable. Consumption and price projections were developed to illustrate the model's use for providing long-term investment and resource planning information.

Scott, Charles T.

1979. Northeastern forest survey board-foot volume equations.
USDA For. Serv. Res. Note NE-271. 3 p.

International 1/4-inch board-foot volume equations are presented for the 17 species groups used in the forest survey of the 14 Northeastern States. The volume equation are nonlinear in form.

Shigo, Alex L.

1978. Diagnosing internal wood rot. Proc. Midwest. Chapter, Int. Shade Tree Conf. 33:58-64.

The Shigometer^R can be used to detect decayed wood in living trees. Details on its use are given.

Shigo, Alex L.

1978. Let's save our trees. News and Views 20:4-5.

Proper tree care starts with an understanding about how a tree responds to injury. Some adjustments in common tree care procedures are discussed.

Shigo, Alex L.

1978. Protecting our beautiful trees. News and Views 20:2-3.

Prevention of wounds and proper treatment of wounds are essential for healthy trees. A general review of tree care procedures is given.

Shigo, Alex L.

1978. Wounds and wound treatments of urban trees. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 6 p.

Forest trees grow under a wide variety of stresses. Only the toughest survive. Urban trees from a nursery do not experience wounding and other stresses until they are planted. Care must be taken in using information about forest trees for urban trees.

Shigo, A. L.

1979. Compartmentalization of decay associated with Heterobasidion annosum in roots of Pinus resinosa. Eur. J. For. Pathol. 9:341-347.

Dissections of roots from five Pinus resinosa trees infected with Heterobasidion annosum showed that the discolored and decayed wood associated with the infections were compartmentalized. A root died when the compartments of infected tissues from multiple infections completely filled the root. This dead root served as the avenue of infection to the next larger root that it was attached to and the pattern of compartmentalization was repeated upward in this manner to the butt and trunk. It is thought that trees that compartmentalize infections to small volumes remain alive despite multiple infections.

Shigo, Alex L.

1979. Decay resistant trees. 26th Northeast. Tree Improv. Conf. p. 64-72.

Compartmentalization of discolored and decayed wood in trees seems to be under genetic control. CODIT is a model that explains compartmentalization in living trees. The Shigometer^R is an electrical pulsed-current meter that can nondestructively detect discolored and decayed wood in living trees. CODIT and the Shigometer now make it possible to begin selecting for trees that can effectively compartmentalize discolored and decayed wood to smaller volumes than other trees of the same species. In this sense, decay-resistant trees can be identified.

Shigo, Alex L.

1979. Tree decay: An expanded concept. U.S. Dep. Agric., Agric. Inf. Bull. 419. 73 p.

Clarifies further the tree decay concept that expands the classical concept to include the orderly response of the tree to wounding and infection, compartmentalization, and the orderly infection of wounds by many microorganisms, successions.

Shigo, Alex L., E. Allen McGinnes, Jr., David T. Funk, and Nelson F. Rogers.

1979. Internal defects associated with pruned and nonpruned branch stubs in black walnut. USDA For. Serv. Res. Pap. NE-440. 27 p.

Dissections of 50 branch stubs from seven black walnut trees revealed that ring shakes and dark bands of discolored wood were associated with 14 of 17 stubs that were "flush cut" 13 years earlier when they were living or dead. Pruning done early in the life of the tree eliminates these problems. When pruning is done late in the life of a tree, care must be taken not to remove the branch collars that form around the bases of dying and dead branches.

Shigo, Alex L., Walter E. Money, and Dale I. Dodds.

1978. Mauguet tree injections: Some internal effects of the wounds. J. Arboric. 3(5):308-313.

Negligible amounts of discolored wood and cambial dieback were associated with control Mauguet injection wounds (no chemicals added) made 1 year earlier on red maple, white oak, and shagbark hickory. Columns of discolored wood and some cambial dieback were associated with wounds that had been injected with Bidrin or Meta-Systox-R. Columns of discolored wood and very little cambial dieback were associated with wounds that had been injected with Fungisol or Stemix. Injured tissues associated with all wounds were compartmentalized in the wood present at the time of injection: wood that formed subsequently was not infected.

Shigo, Alex L., and Walter C. Shortle.

1979. Compartmentalization of discolored wood in heartwood of red oak. *Phytopathology* 69:710-711.

Discolored wood associated with holes drilled into heartwood of living red oak (Quercus rubra) trees was strongly compartmentalized after 2 years; discolored wood associated with similar holes in trees that were girdled immediately after wounding was weakly compartmentalized. The results indicate that heartwood in red oak is not a dead, nonresponsive tissue; the classic concept that heartwood-rotting fungi grow unrestricted through heartwood is not true. The concept of heartrot must be revised to include compartmentalization.

Shortle, Walter C.

1979. Compartmentalization of decay in red maple and hybrid poplar trees. *Phytopathology* 69:410-413.

Samples of wood discolored as a result of drill-bit wounds, the contiguous sapwood, and the bright-colored marginal tissue between them were taken from red maple (Acer rubrum) and hybrid poplar (Populus deltoides x P. trichocarpa) trees. The wounds (1.5 cm diam x 5 cm deep) that initiated discoloration were 1 to 4 years old in maple and 1 year old in poplar. Wood in the marginal zones of both species had a greater concentration of soluble dry matter and phenols than sapwood or discolored wood. Phenols in the marginal zones differed from those of sapwood and discolored wood by solubility in organic solvents, UV spectra, and chromatographic behavior.

Shortle, Walter C.

1979. Detection of decay in trees. *J. Arboric.* 5:226-232.

New ideas and new tools give the arborist new opportunities to better assess the hazard potential of decayed trees. Before using electronics to help detect decay in trees, today's arborist must first train the "mind's eye" to "see" inside the living tree. A model system called CODIT has been developed to explain the patterns of discoloration and decay in wounded trees. With an understanding of the model, a battery-powered drill, and a pulsed-current resistance meter, the arborist can get a good picture of what the inside of a tree is like. With better detection comes the need for better professional judgment to determine how to treat decayed trees.

Shortle, Walter C.

1979. Mechanisms of compartmentalization of decay in living trees. *Phytopathology* 69:1147-1151.

The heartrot concept has failed to explain adequately the patterns of discoloration and decay in living trees. The CODIT system and a concept of succession, in which both pioneer and decay fungi may act as pathogen or saprobe, explain much more. Working hypotheses for the study of molecular mechanisms of compartmentalization can be deduced from these general schemes using three well-established principles of plant and wood pathology: (1) A shift in oxidative metabolism is associated with injury and infection; (2) Food reserves in sapwood converted to products of the

acetate pathway (resinous materials) and the shikimic acid pathway (phenols and other aromatic compounds) cause wood to become more decay resistant; and (3) Bacteria and nondecay fungi grow selectively in wood preserved against decay fungi.

Shortle, Walter C.

1979. Tree care: A new look, 1979. J. Arboric. 5(12):281-284.

Provides an update of new ideas in tree care that have been developed as a result of research on discoloration and decay in living trees.

Highlights of the CODIT model system, which shows how trees compartmentalize after being wounded, are presented along with specific recommendations about how to prevent, diagnose, and treat decay in trees. Included is a list of useful publications about new ideas in tree care, the expanded concept of decay in trees, information packages and models, diagnosis of the internal condition of trees, wound dressings, tree injections, the use of bolts and rods, and new research.

Shortle, W. C., J. Abusamra, F. M. Laing, and M. F. Morselli.

1979. Electrical resistance as a guide to thinning sugar maples. Can. J. For. Res. 9:436-437.

The electrical resistance (ER) of the cambial zone of sugar maples (Acer saccharum Marsh) growing in a stand used for sap production was measured with a pulsed-current meter. Trees of relatively low ER grew faster than those of relatively high ER and produced sap with equivalent sugar content.

Shortle, Walter C., J. A. Menge, and E. B. Cowling.

1978. Interaction of bacteria, decay fungi, and live sapwood in discoloration and decay of trees, Eur. J. For. Pathol. 8:293-300.

Pioneer bacteria found in sapwood and discolored wood may: (1) Contribute to wood discoloration; (2) Alter the rate of cellulase activity of decay fungi; (3) Interact with wood parenchyma to alter the rate of wood colonization by decay fungi and to help provide growth factors and soluble nitrogen. Parenchyma cells seemed to be the major obstacle to the establishment of decay fungi to sapwood. Brief exposure to steam caused many changes in sapwood; this resulted in loss of vitality and loss of resistance to colonization by decay fungi. Whatever factors are lost, bacteria alone do not restore them.

Shortle, Walter C., and Alex L. Shigo.

1978. Effect of plastic wrap on wound closure and internal compartmentalization of discolored and decayed wood in red maple. Plant Dis. Rep. 62:999-1002.

Wounds in 15 red maple trees were covered with black or clear plastic immediately after wounding, or were left untreated. After 12 months, there was a significant improvement in wound closure of the treated wounds compared with that of the controls, but not in the internal compartmentalization of discolored wood. In a separate test, wounds in

nine red maples were covered with plastic 2 weeks after wounding, or were not treated. Sixteen months after wounding, there was no improvement in wound closure, but there was significantly less discolored and decayed wood than in the control wounds. The use of black plastic greatly reduced the occurrence of decay fungi.

Smith, H. Clay.

1979. Natural regeneration and intensive cultural practices in central Appalachian hardwood stands using clearcutting and selection cutting practices. In Regenerating oaks in upland hardwood forests. Proc. 1979 John S. Wright For. Conf. Purdue Univ., West Lafayette, Ind. p. 30-42.

Natural regeneration and stand development by clearcutting and selective cutting practices are discussed for central Appalachian hardwood stands managed for veneer and sawtimber products. Also emphasized are species shade tolerance, regeneration problems, and seedling versus stump sprouts. Intensive cultural practices discussed include crop-tree release and grapevine control.

Smith, H. Clay.

1979. Opinions and predictions on wood energy use. North. Logger 27(7):31.

Smith, H. Clay.

1979. Release of young yellow-poplar and black cherry--10-year results. South. J. Appl. For. 3(4):161-164.

Yellow-poplar and black cherry trees were selected and released 7 years after clearcutting. Ten years after release, the trees were measured. On the basis of diameter at breast height (dbh) and height growth, length of clear bole, survival, change in crown class, and potential as a crop tree, selecting and releasing yellow-poplar and black cherry trees at a young age is not recommended.

Smith, H. Clay, and Roger E. McCay.

1979. Estimating time required to cut grapevines in young, even-aged hardwood stands. South. J. Appl. For. 3(3):125-127.

Man-hours were recorded for cutting grapevines in young even-aged hardwood stands in north-central West Virginia. An equation was developed to predict the number of man-hours per acre needed to cut a given number of grapevines per acre. The predicted times ranged from 1 man-hour to cut 50 grapevines per acre to about 6 man-hours to cut 1,000 grapevines per acre.

Smith, H. Clay, G. R. Trimble, Jr., and Paul S. DeBald.

1979. Raise cutting diameters for increased returns. USDA For. Serv. Res. Pap. NE-445. 7 p.

Diameter-limit cutting is widely used to harvest logs in eastern hardwoods. The value of lumber cut from logs is largely dependent on the diameter,

grade, and tree species. Studies show that many diameter cutting limits are set so low that they sacrifice financial returns.

Smith, Harvey R.

1979. Growth, reproduction and survival in Peromyscus carrying intraperitoneally implanted transmitters. (Abstr.) Int. Conf. Telem. and Radio Tracking in Biol. and Med. C. J. Amlaner, Jr., and D. W. MacDonald, eds. Oxford. p. 57.

Smith, Harvey R., and R. A. Lautenschlager.

1978. Predators of the gypsy moth. U.S. Dep. Agric., Agric. Handb. 534. 72 p.

Smith, James L., and Howard G. Halverson.

1979. Estimating snowpack density from albedo measurement. USDA For. Serv. Res. Pap. PSW-136. 13 p.

Snow is a major source of water in the Western United States. Data on snow depth and average snowpack density are used in mathematical models to predict water supply. In California, about 75 percent of the snow survey sites with an elevation greater than 2,750 meters are in statutory wilderness areas. Needed is a method of estimating the water content of a snowpack in inaccessible locations by remote means. If snow albedo can be measured from aircraft and these measures correlated with snowpack density, we should be able to estimate density remotely. But a correlation must first be established from ground-based observations. This paper reports a study of albedo measured 1 meter above the snow and the correlation of these measurements with snowpack density.

Sonderman, David L.

1979. Guide to the measurement of tree characteristics important to the quality classification for young hardwood trees. USDA For. Serv. Gen. Tech. Rep. NE-54. 12 p.

A procedure for measuring external tree characteristics that are important in determining the current and future quality of young hardwood trees. This guide supplements Forest Service Research Paper NE-419, which describes the quality classification system for young hardwoods.

Sonderman, David L., and Robert L. Brisbin.

1978. A quality classification system for young hardwood trees --the first step in predicting future products. USDA For. Serv. Res. Pap. NE-419. 7 p.

Forest managers have no objective way to determine the relative value of culturally treated forest stands in terms of product potential. This paper describes the first step in the development of a quality classification system based on the measurement of individual tree characteristics for young hardwood stands.

Standley, Stacy, and Wilbur F. LaPage.

1979. Skiers: past, present and potential. In Ski area management, Winter. p. 24-30.

Reports the results of a 1978 nationwide household survey to determine the current size and growth potential of the skier market in America. Eight percent of the over-15-year-old population, or 12.8 million people, skied in 1978; there are 11.2 million downhill skiers, 3.9 million cross-country skiers, and 2.3 million who do both. Another 13.8 million persons are former skiers who did not ski in 1978. About one-half of this group (6.9 million) expect to ski again in the future. And another 7.3 million persons are considered to have a high potential for being attracted into the skier market. The survey also documents rates of participation, and barriers to participation by each market segment.

Stern, E. George.

1978. Stiffness and rigidity of 48" by 40" nailed pallets of 22 southern hardwoods. Va. Polytech. Inst. and State Univ., Wood Res. and Wood Constr. Lab. William H. Sardo, Jr., Pallet and Container Res. Lab. Bull. 158. 48 p.

Stern, E. George.

1978. Testing nails for ductility and toughness. For. Prod. J. 28(1):38-39.

Stern, E. George.

1979. Influence of stringer width on pallet performance. Va. Polytech. Inst. and State Univ., Wood Res. and Wood Constr. Lab. William H. Sardo, Jr., Pallet and Container Res. Lab. Bull. 165. 20 p.

Stern, E. George, and Walter B. Wallin.

1979. Performance of pallet component assemblies in flexure. Va. Polytech. Inst. and State Univ., Wood Res. and Wood Constr. Lab. William H. Sardo, Jr., Pallet and Container Res. Lab. Bull. 162. 28 p.

Eight to 12 replicate, 40-inch long, 5-1/4 inch to 5-1/2 inch wide, leading-edge pallet-deckboard assemblies were tested for static stiffness and maximum flexural load-carrying capacity. The assemblies were of red alder, Fremont cottonwood, California white oak, California black oak, Oregon white oak, bigleaf maple deckboard nailed to Oregon white oak stringers, and coast-type Douglas fir. The bigleaf maple deckboard/Oregon white oak assemblies were stiffer and stronger than those made of the other woods. The California white oak assemblies were the least stiff and the Fremont cottonwood the weakest.

Stern, E. George, and Walter B. Wallin.

1979. Performance of red alder pallets. Va. Polytech. Inst. and State Univ., Wood Res. and Wood Constr. Lab. Bull. 161.

Twenty, non-reversible, double-face, flush, four-way, notched three-stringer, nailed, 48- by 40-inch warehouse and exchange pallets were assembled with partially seasoned red alder from the State of Washington. The wood had a moisture content near the fiber-saturation point during pallet assembly and an average oven-dry specific gravity of 0.40. The pallets were tested, after seasoning of the wood to an average moisture content of slightly less than 10 percent, for static stiffness, impact rigidity, static and impact deckboard-stringer separation resistance, and ultimate load-carrying capacity.

Steuer, Ralph, and Albert T. Schuler.

1979. An interactive multiple-objective linear programming approach to a problem in forest management. J. For. Ecol. and Manage. 2(3):240-256.

Stutzman, Warren, Forrest W. Colliver, and Hewlett S. Crawford.

1979. Microwave transmission measurements for estimation of the weight of standing pine trees. IEEE Trans. Antennas and Propag. AP-27(1):22-26.

Attenuation of a microwave radio link is highly correlated with the weight of foliage of pine trees along its path. In field measurements at 12.25 GHz, the correlation was improved by choosing either vertical or horizontal linear polarization, whichever was less depolarized. The highest correlation was with the weight of leaves and twigs less than 1/2 diameter. This offers a convenient nondestructive way of estimating the weight of foliage in situ.

Townsend, Alden M., and David P. Worley.

1979. Firewood gardens: A renewable energy source. Buckeye Arborist 10(3):2-4.

Trimble, G. R., Jr., and E. H. Tryon.

1979. Silvicultural control of wild grapevines. W. Va. Univ. Agric. and For. Exp. Stn. Bull. 667. 19 p.

Characteristics of grapevines including benefits to wildlife and the damage to trees are discussed. Grapevines seriously damage tree quality and grapevine research for controlling grapevine growth in sapling and mature stands is summarized on the basis of studies from the Fernow Experimental Forest. Recommendations are made for a number of stand situations.

Valentine, Harry T., and David R. Houston.

1979. A discriminant function for identifying mixed-oak stand susceptibility to gypsy moth defoliation. For. Sci. 25:468-474.

Data from 121 stands considered susceptible or resistant to defoliation by gypsy moths were used in computing a discriminant function. The variables of the discriminant function reflect the quantity and quality of certain structural features of trees in forest stands that are used by the gypsy moth for resting, pupation, and oviposition. The susceptibility of a stand can be identified based on the value of its discriminant score. The estimated probabilities of misidentification are 0.104 and 0.136 for susceptible and resistant stands, respectively, within the endemic range of the gypsy moth.

Varshney, C. K., and L. S. Dochinger.

1979. Acid rain: An emerging environmental problem. Curr. Sci. 48(3):337-340.

The acidity in the rainwater has increased considerably in recent years in many developed countries because of growing industrial activities. The ecological consequences of acid rain are of a complex and long-term nature. These include the loss of fertility of the terrestrial ecosystems, and ecological disturbances in the species composition of terrestrial and aquatic communities leading to an overall decrease in the biological productivity. This paper examines the problem of acid rain on the basis of available information and makes a critical appraisal of the environmental problems associated with acid rain phenomena.

Vogel, Willis, G.

1979. Revegetation research on surface-mined land in eastern Kentucky. In 4th Kentucky coal refuse disposal and utilization seminar. [June 6-7, 1978, Lexington, Ky.] p. 5-15.

Revegetating surface-mined lands in eastern Kentucky received little attention before 1958. Thereafter, revegetation efforts based mostly on experience and standard reforestation practices were only occasionally successful. Research by the U.S. Forest Service that began in 1958 helped to define some of the revegetation problems and suggest how to overcome them. Important research was conducted on the suitability of woody and herbaceous species; effects of spoil properties on plants; requirements for fertilizer, lime, mulch, and seedbed preparation; feasibility of all-season seeding; compatibility of trees with herbaceous cover; and microbial associations. Recent research by other Federal and state agencies is discussed.

Wallner, William E.

1978. Protection against insects and diseases. In Urban foresters notebook. Silas Little, ed. USDA For. Serv. Gen. Tech. Rep. NE-49. 4 p.

General considerations are proposed regarding the predisposition of urban trees to insect and disease attack and the importance of management decisions in ameliorating their effects. Also discussed are critical factors influencing urban trees--mixed vs monoculture, tree selection, diagnosis of pest problems, and pest management practices. Sources of information on diagnosing and controlling insect and disease problems are presented.

Wallner, William E.

1979. Induction of diapause in Rogas indiscretus, a larval parasite of the gypsy moth, Lymantria dispar. Ann. Entomol. Soc. Am. 72:358-360.

Induction of diapause in Rogas indiscretus Reardon, a solitary braconid endoparasite of gypsy moth, Lymantria dispar L., was found to be a function of photoperiod and mediated by temperature. At 14 h photophase virtually no diapause developed under any of four temperature regimes. Under 8 and 11 h of light, the percentage of diapause increased with decreasing temperature. Diapause is believed to be regulated by R. indiscretus larvae developing within their gypsy moth hosts. Continual colonization of R. indiscretus does not seem to have changed the diapause response.

Wallner, William E., and Gerald S. Walton.

1979. Host defoliation: A possible determinant of gypsy moth population quality. Ann. Entomol. Soc. Am. 72:62-67.

Gypsy moths, Lymantria dispar (L.), were reared in the field on undefoliated and artificially defoliated gray birch, Betula populifolia Marsh, and black oak, Quercus velutina Lam. The effects of defoliation resulted in reduced pupal weights, longer development time, and reduced survival. These effects occurred in the first year of defoliation and were magnified during the second year. These data suggest that defoliation alters the nutritional quality of the host and influences the population dynamics of the insect. Differences in pupal weights and development time were noted among gypsy moths from six localities reared on the same host species. Higher survival, shorter development time, and larger pupae were obtained in rearings on black oak.

Walters, Russell S.

1979. More vacuum improves yield. Natl. Maple Syrup Dig. 19(1):15-17.

Maple sap volumes collected at 10 and 15 inches of mercury vacuum levels were significantly greater than were collected at the 5-inch level. The 15-inch vacuum level yielded slightly more sap than the 10-inch level, but the difference was not significant. An efficient vacuum system should have a vacuum level of at least 10 inches of mercury at the taphole.

Walters, Russell S., and Alex L. Shigo.

1978. Tapholes in sugar maples: What happens in the tree. USDA For. Serv. Gen. Tech. Rep. NE-47. 12 p.

Sugar maple syrup production begins when the tree is wounded by drilling a taphole. The tree is injured and discolored and decayed wood can result. If trees are tapped, every effort must be made to minimize injury while obtaining the desired amount of sap. Information about tapholes is given to aid the producer. Important points discussed are: compartmentalization of discolored and decayed wood associated with tapholes; tapping procedures that lead to cambial dieback around the hole; overtapping as related to greater use of mechanical tappers; and new information on the use of paraformaldehyde pills, which can lead to more decay in trees.

Walters, Russell S., and Alex L. Shigo.

1979. Paraformaldehyde treated tapholes: Effects on wood. Natl. Maple Syrup Dig. 19(2):13-18.

More decay (higher incidence and longer columns) was associated with sugar maple tapholes treated with paraformaldehyde than with control tapholes. This first became apparent 20 months after treatment. Cambial dieback occurred adjacent to many tapholes, but there was no significant difference in close rates of treated and control tapholes. The results indicate that repeated use of paraformaldehyde will lead to rapid development of decay in sugar maple trees.

Wargo, Philip M.

1978. Judging vigor of deciduous hardwoods. U.S. Dep. Agric., Agric. Inf. Bull. 481. 15 p.

Discusses the meaning of vigor and what a good indicator of vigor (physiological condition) should do. Two indices of tree vigor, starch content of the roots and electrical resistance of the stem tissues, are discussed. Techniques for measuring starch content are given and field application and results of using the starch procedure are presented. Limitations of the electrical resistance technique are presented.

Wargo, Philip M.

1979. Starch storage and radial growth in woody roots of sugar maple. Can. J. For. Res. 9:49-56.

The timing and pattern of starch storage and radial root growth in sugar maple were observed with histochemical techniques. Starch was low in May after budbreak, heavy by mid-July, and continued to increase through October. New xylem growth began in early July and was essentially completed by September. New xylem had no visible starch until late August when starch appeared first in the ray parenchyma and then in the xylem fibers. In contrast to the stem, where growth precedes or coincides with starch storage, storage seemed to have priority for carbohydrates in the roots and may be involved in controlling the timing of radial growth.

Wartluft, Jeffrey L.

1978. Estimating top weights of hardwood sawtimber. USDA For. Serv. Res. Pap. NE-427. 7 p.

Sawtimber top weights, green and oven dry, are shown in tables for Appalachian hardwoods. Weights are given for tree portions greater than 3 inches and less than or equal to 3 inches in diameter. Information on moisture content and percent bark is included. These tables can be used to estimate potentially usable logging residue.

Wartluft, Jeffrey L.

1979. Thrift with wood heat. South. Lumberman 239(2964):12-13.

The author burned wood and used electric heat in his home over 5 winter months and compared costs with the previous 5-month winter period during which only electric heat was used. A total of 1.65 cords of wood were burned, resulting in a savings of \$110 in fuel bills over the previous winter. Wood preparation cost slightly less than \$12 per cord, leaving about \$90 to credit against a \$350 investment in a wood-burning stove and chimney. The value of seasoned firewood equivalent to the average cost of electric power, \$0.03 per kilowatthour, was \$67 per cord or \$31 per ton.

Wendel, G. W.

1979. Growth and survival of three hardwood species as affected by artificial regeneration method. Tree Plant. Notes 30(1):16-19.

The survival and growth of 1-0 bare-rooted seedlings, container-grown seedlings, and direct-seeded seedlings were compared on cutover sites in West Virginia. Planting bare-rooted stock was the best method for establishing black cherry, red oak, and yellow-poplar. After 7 years, 23 percent of the red oak, 70 percent of the yellow-poplar, and 32 percent of the black cherry bare-rooted seedlings equaled or exceeded the height of the competing vegetation. Rodents and competition were responsible for the poor survival and growth of direct-seeded and container-grown seedlings.

Wesoloh, R. M., W. E. Wallner, and M. A. Hoy.

1979. Possible deleterious effects of releasing Anastatus kashmirensis, a facultative hyperparasite of the gypsy moth. Environ. Entomol. 8(1):174-177.

Wharton, Eric, and Robert Nevel.

1979. Northeastern sawmills and lumber production over the years. North. Logger 28(5):22-23, 38.

Lumber production has remained relatively constant over the years while the number of mills has declined. The average mill today produces a higher quality product in greater quantities with production emphasis on hardwoods. The reentry of low-production units in times of high lumber demand is becoming more difficult.

White, W. B., H. B. Hubbard, N. F. Schneeberger, and B. J. Raimo.

1978. Technological developments in aerial spraying. U.S. Dep. Agric., Agric. Handb. 535. 15 p.

Whitney, E. G., and P. A. Godwin.

1979. Changes in the gross morphology of the ventral nerve cord during metamorphosis of the white-pine weevil Pissodes strobi (Peck) (Coleoptera: Curculionidae.) Int. J. Insect Morphol. Embryol. 8:229-236.

Pissodes strobi larvae, pupae, and adults were dissected at 24-hour intervals and the ganglia and interganglionic connectives measured. The larval ventral nerve cord consists of the suboesophageal ganglion, three thoracic ganglia, and eight abdominal ganglia. The adult ventral nerve cord is composed of the oesophageal ganglion, a thoracic ganglion, a thoracic ganglionic mass, an abdominal ganglion, and a terminal ganglionic mass. The sequence in which the larval ganglia fuse to become the adult ganglionic masses is described.

Wilkinson, Ronald C.

1979. Cortical strobic acid concentrations in eastern white pine resistant and susceptible to the white-pine weevil. 26th Northeast. For. Tree Improv. Conf. Proc. p. 121-132.

Resin acid concentrations in cortical oleoresin from 48 weevil-resistant eastern white pines and 40 susceptible trees were analyzed by gas-liquid chromatography. There were no significant differences between weevil-resistant and susceptible groups for any of nine resin acids detected. Strobic acid concentration averaged 22.3 percent of total resin acids in resistant trees; 22.7 percent in susceptible trees. Mean strobic acid concentration was slightly lower in the 20 shortest susceptible trees than in the 24 tallest resistant trees. Of 88 trees sampled, only 2 did not have strobic acid, and both were highly susceptible to weevil attack.

Wilkinson, Ronald C.

1979. Oleoresin crystallization in eastern white pine: Relationships with chemical components of cortical oleoresin and resistance to the white-pine weevil. USDA For. Serv. Res. Pap. NE-438. 10 p.

Strobic acid, a major component of the cortical oleoresin of most eastern white pines, was positively correlated with the rate and extent of oleoresin crystallization. Oleoresin with less than 5 percent strobic acid did not crystallize. Crystallization was positively or negatively correlated with three other resin acids but was not consistently related to any of eight monoterpenes.

Williams, George P., Jr.

1979. Wood chips for dust control on surface-mine haul roads. USDA For. Serv. Res. Note NE-277. 16 p.

On a coal haul spur road where water sprinkling was the primary method of dust control, the duration of control was increased tenfold by covering the road surface with a layer of wood chips. The chip blanket prevented existing dust-size particles from being kicked up and swept into plumes by passing traffic, insulated the road surface against evaporation, and protected it from the pounding and abrasion of truck tires.

Wodzicki, T. J.

1978. Seasonal variation of auxin in stem cambial regions of Pinus silvestris L. Acta. Soc. Bot. Pol. 47:225-231. (PL-480 Proj. PL-FS-72 in Warsaw, Poland, in cooperation with J. A. Romberger).

Although its primary mode of action is still not understood, the hormone "auxin" almost certainly is a key element in the system that controls cambial activity and the development of wood. There is a need for more careful study of the dynamics of auxin movement and of the seasonal variation in its concentration at different heights in the stem. The results of extensive analyses of available data are discussed. It is suggested that the developmental information carried by auxin may be related not only to its concentration, but also to changing responsiveness of the developing cells.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011(19) Beltsville, MD 20705.

Wodzicki, T. J., A. B. Wodzicki, and S. Zajaczkowski.

1979. Hormonal modulation of the oscillatory system involved in polar transport of auxin. *Physiol. Plant.* 46:97-100. (PL-480 Proj. PL-FS-72 in Warsaw, Poland, in cooperation with J. A. Romberger).

During the past 40 years there has been a tremendous accumulation of difficult-to-interpret observations of plant responses to auxin and of hypotheses about how auxin might control plant development. New and different kind of data are presented that represent the beginning of what may become a new theory of auxin action. Wave-like patterns of auxin efflux from series of short stem segments of pine trees are used to infer the existence of an oscillating morphogenic field in the stem. This field is under apical control and is strongly influenced by application of synthetic hormones to the apex. This basic research has extensive theoretical significance.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19), Beltsville MD 20705.

Wolf, Charles H., and Gilbert P. Dempsey.

1978. Logging work injuries in Appalachia. USDA For. Serv. Res. Pap. NE-416. 13 p.

An analysis of 1,172 logging injuries in Central Appalachia revealed that nearly half of all time lost--and almost all fatalities--resulted from accidents during felling and unloading. To save lives and reduce costs, logging safety programs should: (1) Provide intensive safety training for the young and new workers; (2) Place renewed emphasis on safety during the late spring and early summer; and (3) Focus on safety measures for felling and unloading operations. Statistical summaries needed for the development of workable safety programs are included.

Wolf, Charles H., and Gilbert P. Dempsey.

1979. Logging work injuries in Appalachia. *South. Lumberman*, December 15, p. 75-82. [Reprinted from *Logging work injuries in Appalachia*. 1978. USDA For. Serv. Res. Pap. NE-416. 13 p.]

Wollerman, Edward H.

1979. Attraction of European elm bark beetles, *Scolytus multistriatus*, to pheromone-baited traps. *J. Chem. Ecol.* 5:781-793.

Newly emerged Scolytus multistriatus reared in the laboratory were marked, released in the field, and recaptured on sticky pheromone-baited traps at various distances. Four groups of beetles were conditioned before release by providing food, flight exercise, both food and flight, or by withholding food and flight for 24 hours to determine effect of treatment on pheromone response. Average catches per trap for untreated beetles and the respective treatments were 5.5, 2.1, 1.0, and 0.6. Overall recovery ranged from 3 to 8 percent of 58,421 marked beetles released in four experiments. Combined feeding and flight exercise resulted in low trap response but flight to distant traps increased. Beetles held with no food or flight showed the lowest response. Endemic S. multistriatus responded to all traps with catches ranging from 13 to 17 times the number of marked beetles recaptured.

Wollerman, Edward H.

1979. Dispersion and invasion by Scolytus multistriatus in response to pheromone. Environ. Entomol. 8:1-5.

When 18,416 adult Scolytus multistriatus were marked with a fluorescent powder and released, 27 percent were recaptured in pheromone-baited traps. Of these, 98 percent were captured on traps 1.5 meters from the release point, but the maximum distance for capture was 160 meters. In another phase of the study, adult beetles were marked with ^{32}P as they emerged from elm logs. Of 1,964 beetles subsequently captured in pheromone-baited traps, 63 percent were 1.5 m from the emergence site. Endemic S. multistriatus from unknown sources were caught in all traps, with an average of 2,553 per trap and a total of 51,059. They were found at all trap heights to 4.8 meters. The distribution pattern showed the largest number to be in traps at the perimeter of the open field, with lesser numbers toward field center, where the number again increased.

Yawney, Harry W., Clayton M. Carl, Jr., and Michael S. Greenwood.

1978. Procedures for rooting and overwintering sugar maple (Acer saccharum Marsh.) cuttings. Proc. 5th North Am. For. Biol. Workshop. Univ. Fla., Gainesville. p. 412-413.

Yawney, Harry W., Albert L. Leaf, and Raymond E. Leonard.

1978. Nutrient content of throughfall and stemflow in fertilized and irrigated Pinus resinosa Ait. stands. Plant and Soil 50:433-446.

Measurements of P, K, and Ca in throughfall and stemflow from K-fertilized and irrigated red pine plantations indicated that fertilization resulted in increases, while irrigation resulted in decreases in the amount of these elements contained in net rainfall (attributed to foliar leaching); Mg was inversely related to both treatments.

Yingling, E. L., C. A. Keeley, S. Little, J. Burtis.

1979. Reducing damage to shade and woodland trees from construction activities. J. Arboric. 5(5):97-105.

Guidelines are given for reducing damage to trees from installing underground utility lines, making road and grade cuts and fills, and constructing home developments. Observations and experience, especially in

supervising construction that affected trees on rights-of-way in Maryland, and the available literature provide the basis for the guidelines. Case histories show effects ranging from no apparent injury to extensive damage.

Zajaczkowski, Stefan, and J. A. Romberger.

1978. Polarity of xylem formation in isolated stem segments of Pinus silvestris. *Physiol. Plant.* 44:175-180.

Sterile culture of isolated stem segments was used to study polarity phenomena in relation to wood formation in Scotch pine. Data from several types of culture experiments led to the conclusion that apicalbasal polarity is a much more significant factor in control of cambial activity than the actual direction of nutrient flow. Gravity effects also are secondary to polarity. This strengthens the case for auxin control of cambial activity because the movement of auxin in living stem tissue is strongly polar in the basipetal direction.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19) Beltsville MD 20705.

Zajaczkowski, S., and T. J. Wodzicki.

1978. On the question of stem polarity in respect to auxin transport. *Physiol. Plant.* 44:122-126. (PL-480 Proj. PL-FS-72 in Warsaw, Poland, in cooperation with J. A. Romberger).

The plant growth hormone auxin is translocated through plant stems from the tip toward the base much more readily than in the other direction. This polarity of movement is poorly understood, especially in tree stems. This paper reports results of studies of auxin movements through pine stem segments of various lengths. It is clear that both upward and downward auxin movement declines with increasing length of sections. The polarity quotient, however, varies little. It is postulated that in a segment an integrated system of cell polarities produces a wave along the stem. Such waves are manifested by the observed variable effluxes of auxin from the basal ends of segments. This information is part of the input the authors are using in the formulation of a new theory of auxin action.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-WEST, Bldg. 011 (19), Beltsville MD 20705.

Zajaczkowski, S., and T. J. Wodzicki.

1978. Auxin and plant morphogenesis--a model of regulation. *Acta Soc. Bot. Pol.* 47:233-243. (PL-480 Proj. PL-FS-72 in Warsaw, Poland, in cooperation with J. A. Romberger).

The first presentation of a body of new concepts about how auxin may regulate the large set of growth processes that determine the form of a plant. The new theory is explained by reference to a model system in which the plant body is a 3-dimensional spatial medium. Morphogenic waves of auxin activity are propagated from the apex toward the base through this medium. Cells and groups of cells operate as local oscillatory components of a larger system and give rise to auxin wave vectors. The latter carry positional and timing information recognized by developing cells. The model and the theory are attractive because they open new avenues of experimentation in a field that has been stalemated for decades.

Copies of this publication are available from John Romberger, RWU-1110, Forest Physiology Laboratory, ARC-West, Bldg. 011 (19) Beltsville MD 20705.

Northeastern Forest Experiment Station.

1981. 1979 Report. Northeast. For. Exp. Stn.,
Broomall, Pa.

82 p. (USDA For. Serv. Gen. Tech. Rep. NE-63)

A summary report on highlights of research activities and accomplishments of the Experiment Station in 1979, including an annotated list of publications.

(74/75) : 945.4 : (047.1)

Headquarters of the Northeastern Forest Experiment Station are in Broomall, Pa. Field laboratories and research units are maintained at:

- Amherst, Massachusetts, in cooperation with the University of Massachusetts.
 - Beltsville, Maryland.
 - Berea, Kentucky, in cooperation with Berea College.
 - Burlington, Vermont, in cooperation with the University of Vermont.
 - Delaware, Ohio.
 - Durham, New Hampshire, in cooperation with the University of New Hampshire.
 - Hamden, Connecticut, in cooperation with Yale University.
 - Kingston, Pennsylvania.
 - Morgantown, West Virginia, in cooperation with West Virginia University, Morgantown.
 - Orono, Maine, in cooperation with the University of Maine, Orono.
 - Parsons, West Virginia.
 - Princeton, West Virginia.
 - Syracuse, New York, in cooperation with the State University of New York College of Environmental Sciences and Forestry at Syracuse University, Syracuse.
 - University Park, Pennsylvania, in cooperation with the Pennsylvania State University.
 - Warren, Pennsylvania.
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